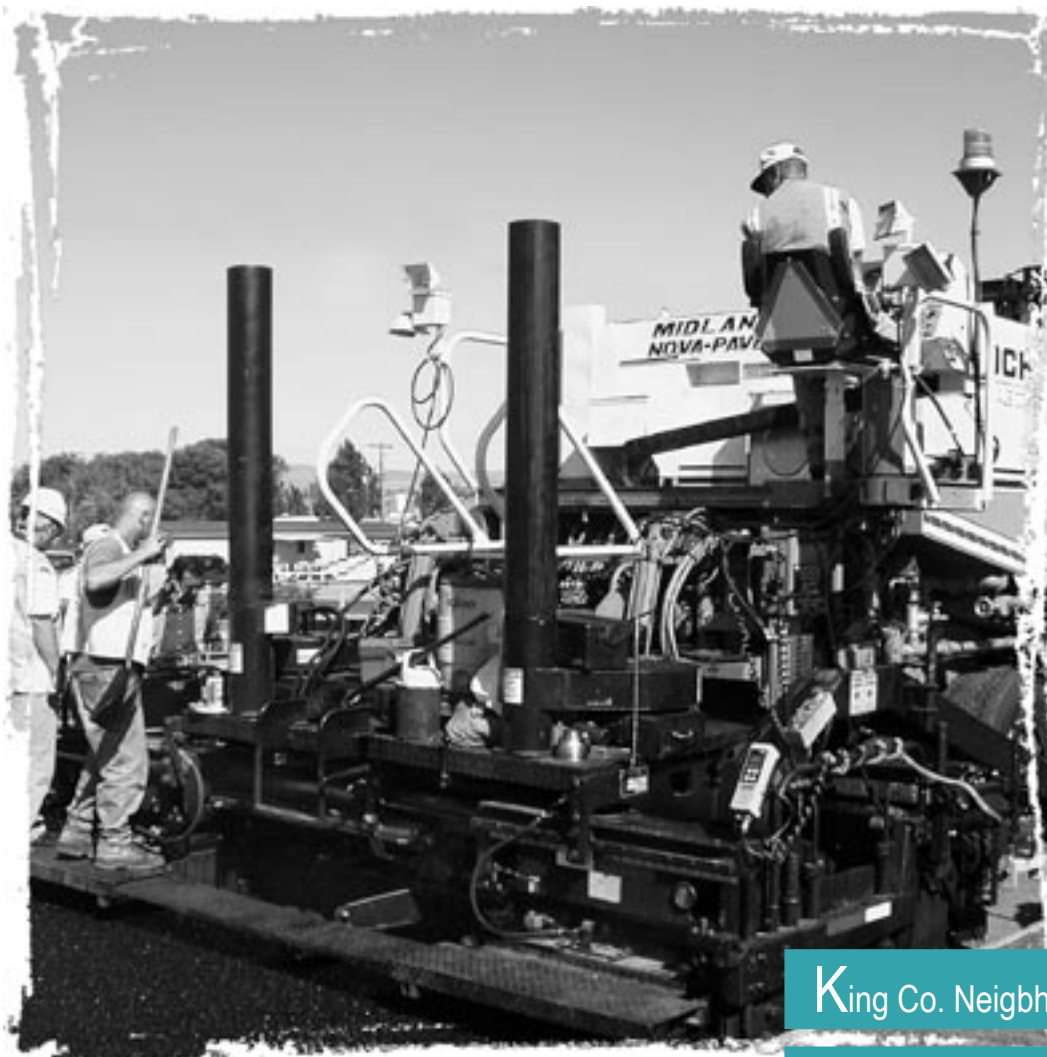




WST2

Washington State Technology Transfer



King Co. Neighborhood Safety pg 22

Highway Rockfall Hazards pg 30

Design-Build On-Track pg 12



**Washington State
Department of Transportation**

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Editor reserves the right to refuse to publish and to edit articles to conform to the standards of our publication.

The opinions expressed in articles are not necessarily those of the editor.

Contents

From the Editor's Desk	2	PQT News	40
Technology News	4	2002 Partnerships for Quality Transportation (PQT) Making A Difference Awards Presented	40
American Bar Association (ABA) Initiates Pro Bono Legal Assistance for Community Projects	4	Team Effort Produces Positive Results in Southeast Washington	41
DOT Releases Preliminary Estimates Of 2001 Highway Fatalities	5	NWPMA News	42
Web Services-A New Trend	6	Words from the Chair	42
Interested in Working in the Woods?	7	Tips on Team Motivation	43
FHWA Video to Assist in Utility-Relocation and Road Building Now Available	8	USDOT FHWA/NHTSA	44
Jack Manicke Retires from WSDOT and WST2 Advisory Committee	8	New Users Guide Focuses on Creating Pedestrian Safety	44
Road Maintenance Training Videos Available for Loan	9	FHWA Software Package Estimates Work Zone Traffic Delays	45
The National Work Zone Memorial Wall Visits Washington	10	Next Generation of Inspectors Will Fly Under Tall Bridges	46
Application To HostThe National Work Zone Memorial	11	Latest Highway Construction Specs on the Web	47
Articles	12	HSIS Develops New Online Safety Database Website	48
WSDOT Design-Build Project On Track for Early Completion	12	BTEP	49
SR 17 NovaChip Demonstration Project - One Year Later	13	"Weeds Across Borders"	49
Securing the Roads US Actions to Enhance Surface Transportation Security	14	WSDOT Library	50
Strengthening Communication Between the Design and Construction Sections	18	Legislation and the Segway Human Transporter	50
King County Completes Significant Effort in Neighborhood Traffic Safety Program	22	Roger's Technology Toolbox 2002	52
The Segway Human Transporter (HT)	25	GPS "Beam Me Up, Scotty"	52
Evaluation of Virginia's First Heated Bridge	26	WST2 Resources	56
Boosting Roadway Safety with Rumble Strips	29	Training Opportunities	58
Design Guide Offers New Look at Mitigating Highway Rockfall Hazards	30	Conferences	63
Mousetraps	32	Sign of the times	64
Jack Moltz'sUnder Guardrail Cleaner	32		
WSDOT Aberdeen Maintenance Culvert Cleaning and Relining Process	36		



Dan Sunde
Technology Transfer Engineer
WST2 Center

It's hard to believe but the 2002 Pacific Northwest Transportation Technology Expo is here. Over the past two years the Expo has grown and promises to be even bigger and better this year. We in the T2 Center believe this is one of the most effective events we sponsor each year. One of the biggest benefits of the Expo is it provides attendees with practical tools and information that can be put to use immediately because they are developed by people in the field, have been proven effective, and can be built or created in-house. I encourage you and your agency to not only attend the Expo, but also bring an invention of your own to share. Your idea can save others time, effort, dollars, and backaches! We receive reports constantly of mousetraps being implemented with great success. Hope to see you there.

Since our last issue of the WST2, Jack Manicke, a 10-year member of our Advisory Committee and a 35-year employee of WSDOT, retired. Jack has been a strong supporter of the Center and an active participant in providing assistance to local agencies. He will be greatly missed and I wish him the very best in his well-earned retirement.

Have a safe summer.

Dan

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Any opinions, findings, conclusions or recommendations presented in this newsletter are those of the authors and do not necessarily reflect the views of WSDOT or FHWA. All references to proprietary items in this publication are not endorsements of any company or product.



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American Bar Association (ABA) Initiates Pro Bono Legal Assistance for Community Projects

The American Bar Association's Special Committee on Second Generation Issues announced the initiation of Pro Bono Legal Assistance for Communities ("PBLAC") pilot project in early April 2002. The pilot project attempts to match the legal assistance needs of communities undertaking environmental projects with volunteer attorneys from the ABA Section on Environment, Energy and Resources who will provide pro bono (free) legal support for specifically defined tasks/projects. The PBLAC pilot project provides opportunities for attorneys to learn, serve, and gain experience by participating in community-based environmental projects - one of the newest approaches to environmental protection. These new approaches, often referred to as "second generation" approaches, move beyond the traditional media-specific, command and control approaches (i.e., first generation approaches) and explore the use of more integrated systems that may provide better and more cost-effective environmental protection. The PBLAC Pilot was developed in coordination with U.S. EPA's Community Based Environmental Protection ("CBEP") Coordinators and provides legal support to communities undertaking integrated, "second generation" CBEP efforts. The volunteer attorneys gain first-hand experience in these cutting-edge environmental approaches, while also providing a critical service to communities.

The PBLAC pilot project provides opportunities for attorneys to learn, serve, and gain experience by participating in community-based environmental projects - one of the newest approaches to environmental protection.

The types of assistance available under the PBLAC may include: analysis, counseling, policy development, drafting of sustainable development tools (i.e., conservation easements or plans, local ordinances, environmental or resource management plans), facilitation, mediation, alternative dispute resolution, and other non-litigation types of support. Communities interested in participating in PBLAC will complete an application specifically describing their CBEP project, the type of legal assistance needed,

and the expected time commitment involved for the lawyer. Attorneys interested in volunteering for the Pilot may identify areas of particular interest or may volunteer generally. PBLAC will work to match the interests and availability of the attorneys with the needs of the communities. In each case, the volunteer attorney will have the opportunity to accept or decline the particular assignment.

Community environmental project leaders who want to know more about the Pro Bono Legal Assistance Pilot Project can go to the ABA website for information on applying. Attorneys interested in participating can also get more information at that site or contact the PBLAC Coordinator, Brenda Gotanda, Vice Chair of the Special Committee on Second Generation Issues, at bgotanda@mgklaw.com or 484-430-2327.

For more information, and to get a copy of the nomination form, see the ABA website at: <http://www.abanet.org/environservice6.html> ▲



DOT Releases Preliminary Estimates Of 2001 Highway Fatalities

The United States Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced its preliminary analysis of highway traffic fatalities in 2001. According to these estimates, traffic fatality and injury rates remained at historic lows in 2001. Deaths of children ages 15 and under dropped to the lowest level since record keeping began.

The preliminary fatality rate per 100 million vehicle miles (VMT) was 1.50 in 2001, a statistically insignificant change from the final 2000 rate of 1.52. The total number of people killed in highway crashes in 2001 was estimated to be 41,730, compared to 41,821 in 2000. The number of people injured dropped from 3.2 million in 2000 to 3.0 million in 2001. Vehicle miles traveled increased slightly to 2.778 trillion in 2001, up from 2.75 trillion in 2000.

"Losing nearly 42,000 of our friends, neighbors and family members to highway crashes is unacceptable," said U.S. Transportation Secretary Norman Y. Mineta. "All of us – individuals as well as government – must work together to change the nation so that highway safety is every American's priority."

The 2001 statistics also continue to show the increased risk of death and injury when drivers and passengers do not wear seat belts or have their children properly restrained in child safety seats: 60 percent of those killed in crashes

*"All of us
– individuals as
well as government
– must work
together to change
the nation so that
highway safety is
every American's
priority."*

last year were not belted.

"As an emergency physician, I can tell you firsthand that a seat belt often makes the difference between survival and death in a crash," said Jeffrey W. Runge, M.D., NHTSA Administrator. "The data are clear about the value of seat belts in reducing the severity of injury and the economic cost to society."

NHTSA's Fatality Analysis Reporting System (FARS) also shows that in 2001:

- Motorcycle fatalities increased for the fourth year in a row following years of steady improvement. With 3,067 killed in 2001, it was the highest number of motorcycle fatalities since 1990.
- The percentage of alcohol-re-

lated deaths in 2001 remained unchanged at 40 percent – 16,652 deaths.

- Fatalities involving large truck crashes dropped from 5,211 in 2000 to 5,192 in 2001.
- The number of pedestrians killed, 4,698, remained virtually unchanged.
- Young drivers (16-20) were involved in 7,547 fatal crashes in 2001 compared to 7,607 in 2000.
- The number of fatalities for children under five dropped 5.4 percent from 706 in 2000 to 668 in 2001.
- The number of fatalities for children ages five to 15 dropped 5.5 percent from 2,105 in 2000 to 1,990 in 2001.

NHTSA annually collects crash statistics from 50 states and the District of Columbia to produce the annual report on traffic fatality trends. The final 2001 report, pending completion of data collection and quality control verification, will be available in August 2002. Summaries of the preliminary report are available on the NHTSA website at <http://www.nhtsa.dot.gov>. ▲

Web Services-A New Trend

By Garyn Perrett, President, iWorQ Systems, Inc.

For most of us, the Internet is a source of endless information and a tool for communications with friends and colleagues. However, more and more of us are using the Internet to handle daily tasks like making travel plans, paying bills, balancing

such as pavements, signs, sidewalks, markings, sewer, fleets, and more.

Unlike software applications that reside on a single computer or a local area network, Web Services are available from any computer with Internet access and allow information to be shared with everyone in the organization.

Web Services are easy to use, convenient, and less expensive than traditional software. In addition, Web Services require no installation, no configuration, no upgrades, no software licenses, no networks, and no servers.

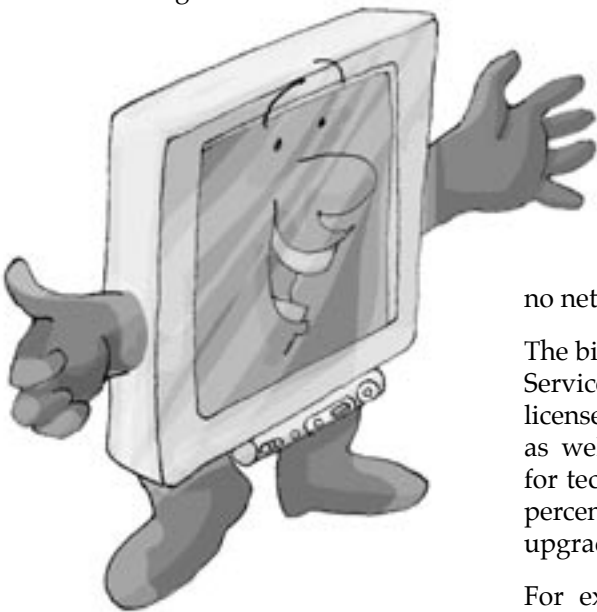
The biggest advantage of Web Services is the cost. A software license can cost \$800-\$15,000, as well as, 20 percent yearly for technical support, and 70 percent for each additional upgrade.

For example, if you purchase three software packages to manage your pavements, signs, and markings, with the average cost of \$3,000 each, you would pay \$9,000 upfront, \$1,800 each year for support, and \$6,300 dollars every two or three years for upgrades.

With Web Services, it's very simple; no upfront costs and a low monthly service fee for technical support and upgrades. For example, the same three Web Services to man-

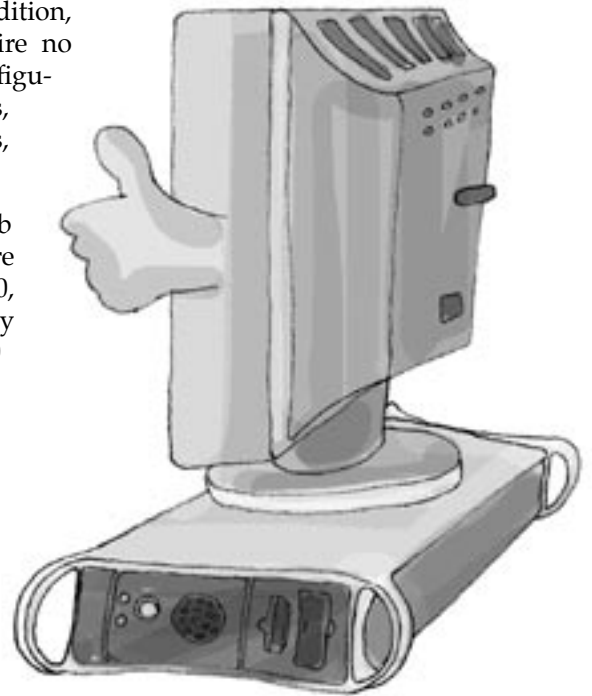
age your pavements, signs, and marking, would cost \$100-\$200 per month. Web Services are changing the way we work and the way we communicate

The Internet and Web Services can assist local government agencies in many ways. These tools combine the skills of local government agencies, service providers, and industry experts to solve problems. How can Web Services help you?



checkbooks, scheduling appointments, checking cell phone minutes, buying or selling items, and much more. These relatively new Internet features are called Web Services.

New Web Services are available every day to assist us at home and at work. Government agencies are using Web Services to file deeds, titles, legal descriptions, and tax information. In addition, government agencies are using Web Services to manage infrastructure



For questions or additional information please contact Garyn Perett at (435) 755-5126 or e-mail gperrett@iworq.com. ▲

Interested in Working in the Woods?

*By Marge Hutchinson, PE, South
Zone Engineer, Okanogan-Wenatchee
National Forest*

The Okanogan-Wenatchee National Forest will soon be advertising for one or two engineering positions. We are looking for energetic, motivated Engineers or Engineering Technicians at the GS 9/11 level (similar to Transportation Engineer 3 or Transportation Engineer 4 in the Washington State Dept. of Transportation system) interested in working for the US Forest Service in the Cle Elum and Yakima areas. As an engineering employee for the Forest Service, you could be involved in a wide variety of projects. Typical projects include road and bridge construction and maintenance, recreation construction or restoration projects such as campgrounds and trails, ecosystem restoration projects, building construction and maintenance, water systems, and the occasional air-tanker base construction project. With most projects you will follow progress from inception through to construction.

There are many benefits in working for the Forest Service. You will work in some of the most beautiful country around. Our offices are usually in quiet rural settings, away from urban congestion. Your project might send you to the wilderness to survey a trail system or to a scenic river setting to administer a bridge. Due to re-

cent retirements, there is currently considerable promotion potential within the Forest Service. In addition, there are many opportunities to take on special projects, details, and even opportunities to participate on fire teams.

The GS 9/11 positions will include both field and office duties. The successful candidate will perform a variety of work including road reconnaissance surveys; building and utility surveys and inspections on Forest administrative sites and facilities; design and layout of roads, trails, bridges, drainage structures, and other systems of moderate complexity; administration of construction and maintenance contracts to insure compliance with the terms and conditions of the contract; preparation and interpretation of plans and specifications; assistance with database programs; and support and assistance to the Zone Engineer.

SALARY

Engineer

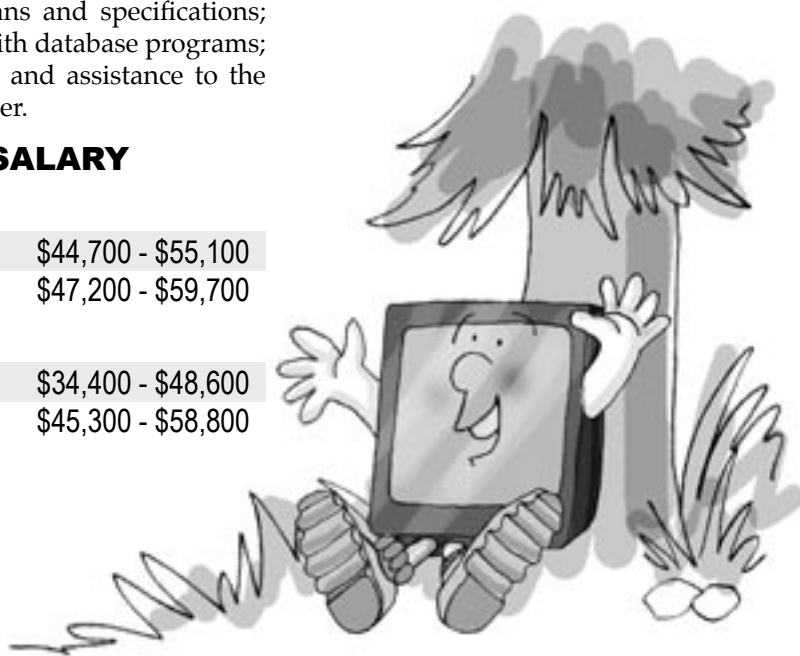
GS-9:	\$44,700 - \$55,100
GS-11:	\$47,200 - \$59,700

Technician

GS-9:	\$34,400 - \$48,600
GS-11:	\$45,300 - \$58,800

Other benefits include health and life insurance, generous annual leave starting with three weeks and working up to five weeks per year, twelve days of sick leave per year, ten paid holidays, and an excellent retirement plan, including an optional tax-deferred retirement investment program.

To learn more about these positions and other potential positions within Region 6, (Region 6 is OR and WA) contact Rick Emmick, Forest Engineer, at (509) 664-2780 or Marge Hutchinson, South Zone Engineer, at (509) 653-2205 ext 261. To find out more about meeting qualification requirements, contact Human Resources at (509) 662-4235. ▲



FHWA Video to Assist in Utility- Relocation and Road Building Now Available

Source: the AASHTO Journal, May 31, 2002

The Federal Highway Administration has produced an informational video titled *CCC: Making the Effort Works!* Targeting agencies involved with highway construction and utilities, the 19-minute video outlines approaches used in seven states to coordinate utility relocations in a manner that saves time and money for each party involved. The video is based on the *AASHTO Utilities Guidelines and Best Practices*. It provides practical help in navigating the process with a strong emphasis on forming partnerships.

King W. Gee, FHWA's Program Manager for Infrastructure, points out that the three principles of coordination, cooperation, and communication, or "CCC", are useful to infrastructure builders and the utility staff they work with by allowing them to share information early with improved results.

Jack Manicke Retires from WSDOT and WST2 Advisory Committee



Jack Manicke (left) receives certificate of recognition from Phil Barto (right), Spokane County, Maintenance Engineer and WST2 Advisory Coommittee Chairman

After a thirty-four year career with the WSDOT and serving on the WST2 Advisory Committee for over 10 years, Jack Manicke announced his retirement as of the end of June. Jack has been a long valued member of the WST2 Advisory Committee, providing much appreciated support and assistance. Jack has consistently provided valuable input to the WST2 Center

and he has written several practical articles for the WST2 newsletter, sharing his broad based knowledge and expertise with the local agencies in Washington. His enthusiastic support will be missed.

We in the WST2 Center wish Jack the very best in his retirement and future endeavors. ▲

"Making the commitment (a fourth 'C') to CCC has not been a high enough priority with most agencies and utility companies," Gee said. So FHWA produced the video to help.

For additional information and copies of the video please contact Paul Scott at (202) 366-4104 or John Perry (202) 366-2023 at the FHWA. ▲

Road Maintenance

Training Videos Available for Loan

The Road Maintenance Training Video Set consists of five videos. The content of the video set progresses from an overview to the step-by-step methods of blading a road. USDA Forest Service Engineering, San Dimas Technology and Development Center, 2002, developed the video set. Road management and maintenance personnel will benefit from a better understanding of the challenges of maintaining rural, remote roads.

Call the WST2 Center at (360) 705-7386 to borrow these tapes.

#429

Forest Roads and the Environment

Road Maintenance Series #1
18 Minutes

This video is a visually pleasing overview of how the road and environment interact with each other. It provides an introduction to the maintenance of low volume roads, highlighting issues that benefit from proper maintenance activities, such as water temperature, fish habitat and aggregate surfacing loss.

#430

Reading the Traveled Way Road Maintenance Series #2 16 Minutes

This video focuses on understanding the condition of the road and provides insights on how to proactively avoid costly repairs by properly addressing the road in its current condition. Shows rutting, washboarding, potholes, destroyed road template, cracks, flour, loss of surfacing, excessive vegetation, water bypassing surface cross drains, damaged or filled cattle guards, damage to bridges, and damage to fords.

#431

Reading Beyond the Traveled Way Road Maintenance Series #3 17 Minutes

This video considers the natural functions happening beyond the roadway (rain, erosion) and how to use that knowledge before beginning maintenance operations to help minimize significant impacts on the road. Covers gullies, cracks and slumps, roadside ditch, ditch relief culverts, live stream culverts, and brush removal.

#432

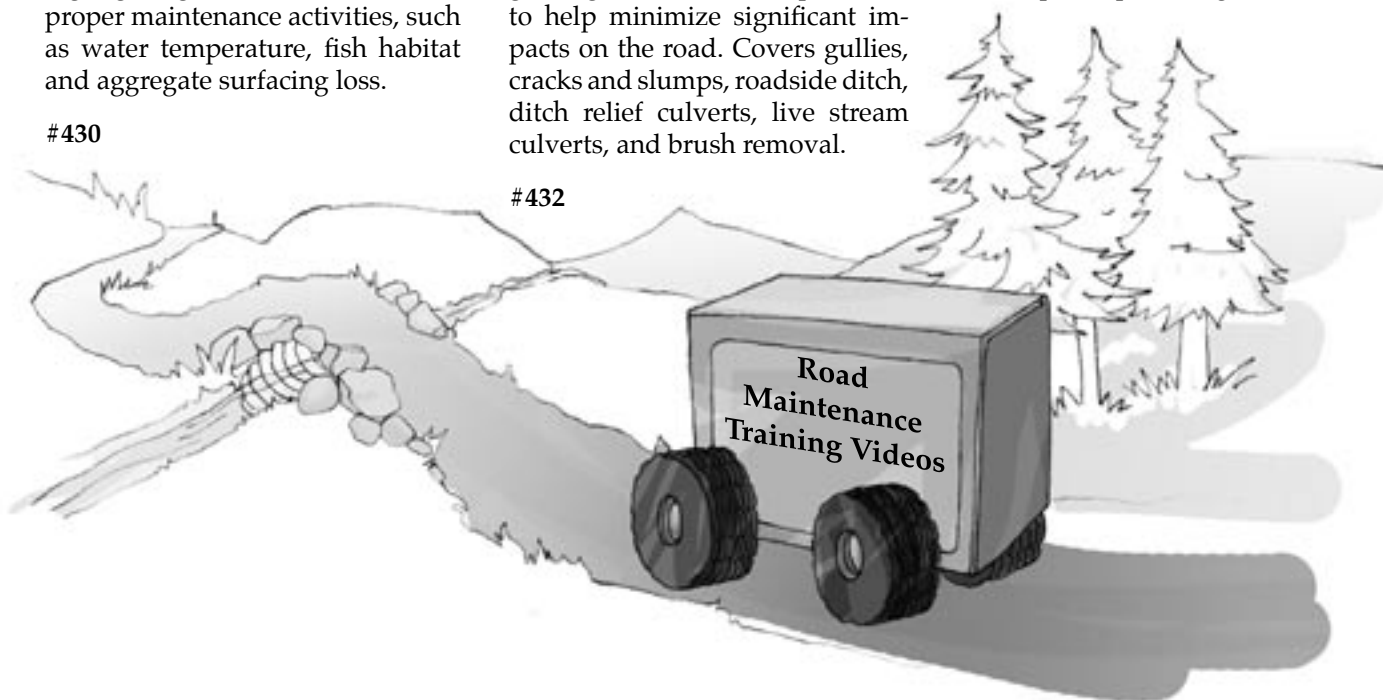
Smoothing and Reshaping the Traveled Way Road Maintenance Series #4 18 Minutes

This video covers detailed step-by-step processes used for both smoothing and reshaping a road. Covers crowned, insloped and out-sloped roads as well as transition sections.

#433

Maintaining the Ditch and Surface Cross Drains Road Maintenance Series #5 16 Minutes

This video provides comprehensive instructions for correctly constructing and maintaining ditches, culverts and various surface cross drains. Highlights rolling dips, earthen water bars and interceptor dips. Covers heeling the ditch, pulling the ditch, maintaining surface cross drains, rolling drain dips, interceptor dips, earthen water bars, and open-top drainage devices. ▲



The National Work Zone Memorial Wall Visits Washington

By Marty Weed, WSDOT-Olympic Region

The Washington State Department of Transportation was host this past May to a traveling display for the National Work Zone Memorial Wall on its inaugural cross-country trek. The purpose of the wall is to encourage motorists to drive carefully in construction work zones and to honor those who lost their lives on our nation's roadways.

The memorial wall was designed as an everlasting tribute to those individuals who were killed on roadways across the nation in a designated construction work zone. The wall not only recognizes those workers on the roadway who died, it also pays respect to law enforcement officers, emergency service workers, motorists, pedestrians, and children who died while within a work zone.

The American Traffic Safety Services Association (ATSSA), which represents companies that sell traffic control devices, unveiled the memorial wall in April at the National Work Zone Awareness Week ceremony in Maryland. More than 700 names are etched into the wall panels.

While the wall was here in Washington, it was on display at various locations including the WSDOT Seattle Headquarters, WSDOT Olympia Headquarters, WSDOT Chehalis area maintenance facility, the State Capitol Rotunda, and the Washington State Dept. of Labor & Industries build-



ing in Tumwater. The display at WSDOT Olympia Headquarters was for the 2nd annual worker memorial ceremony held to honor the 55 fallen WSDOT employees at a touching ceremony attended by many fellow department workers, legislative dignitaries, and family members.

The wall will be making a return trip to Washington State this September 11th and 12th and will be on display at the Pacific Northwest Transportation Technology Expo at the Grant County Fairgrounds in Moses Lake.

As the National Work Zone Memorial continues its successful tour of the United States, ATSSA is beginning the process of collecting names for addition to the Memorial in early 2003. Reservations are also currently being taken for those states or entities that are interested

in hosting the wall.

Anyone interested in submitting names is asked to prepare your list of names and submit it to ATSSA at your earliest convenience. Also, please encourage any colleagues in other jurisdictions, contracting companies, or states to collect and submit their names. The goal is to have representation from all 50 states by 2004.

Name submission forms along with additional wall information are easily available on the ATSSA web page at www.atssa.com. Just click on "Public Information," then "NWZ Memorial".

For specific information or questions on the wall you may contact Mr. Jim Baron at ATSSA at 1-800-272-8772. For information on the Washington State Department of Transportation displays you may contact Mr. Martin Weed at 360-357-2766. ▲

Application To Host The National Work Zone Memorial

Location _____

City _____ State _____

Nearest Major Metropolitan Area _____

Contact _____ Name _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____ Email _____

Host Organization _____

Organization Name _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____ Email _____

Preferred Dates for Memorial Visit* _____

1) _____

2) _____

3) _____

**Please include Month/Days/Year. ATSSA recommends a maximum 4-day visit, in order to focus community attention most effectively. ATSSA will do its utmost to make the Memorial available to your organization on the requested dates. However, scheduling and travel requirements may cause us to ask for patience or flexibility, so that we may satisfy the needs of as many prospective hosts as possible. You will receive confirmation of the visit and dates in writing.*

For photos of the exhibition components, and additional details, please visit www.atssa.com and click on "Public Information."

WSDOT Design-Build Project On Track for Early Completion

By Jeff Carpenter, Innovative
Contracting Engineer, WSDOT HQ
Construction

Washington State Department of Transportation's (WSDOT) pilot design-build project is on track for the scheduled early completion of October 1, 2002. The SR 500 / Thurston Way Interchange is a \$22.7 million dollar grade separation project which will serve the Vancouver Mall and adjacent communities. The current at-grade intersection is the primary entrance into the mall and traffic has been staged through the work area during construction.

The project included a requirement that any temporary lane configuration provide the same function and capacity as the existing lane configuration during the holiday season from November 1, 2001 through January 1, 2002. This configuration helped to minimize the impacts to the Vancouver Mall.

The SR 500 / Thurston Way Interchange project is WSDOT's first use of the design-build contracting tool. Design-build combines both the contractor and designer into a single team to produce the best value product to WSDOT.

The primary advantage of design-build is that the contractor is able

The primary advantage of design-build is that the contractor is able to start work on initial segments of the project as designers continue to work toward final completion.

to start work on initial segments of the project as designers continue to work toward final completion. This integration between designer and contractor helps to mitigate any design conflicts that are discovered in the field as well as accelerate the overall delivery process.

WSDOT has a new role in the design-build process. Rather than assuming a supervisory role, the project office is focusing more on project oversight. Since WSDOT does not own the design, conflicts

are resolved internally within the design-builders structure (which results in a lower staffing requirement for WSDOT). However, the expertise required of WSDOT is much higher than on a typical project.

As a pilot project, the SR 500 / Thurston Way Interchange is being measured from both within WSDOT and through an outside consultant (University of Colorado-Boulder). All participants involved in the process are interviewed to help WSDOT determine how to make improvements to the process. Two interim reports have been developed as well as a tracking system for all issues occurring throughout the project. WSDOT has created a Design-Build team with the Association of General Contractors (AGC) and the American Council of Engineering Companies (ACEC) to help address issues as they develop. The resolutions to the issues are incorporated into WSDOT's Design-Build Guidebook.

For more information regarding WSDOT's Design-Build Program and Guidebook, along with other innovative contracting tools, please visit www.wsdot.wa.gov/biz/InnvContract/desbuild.htm

SR 17 NovaChip Demonstration Project - One Year Later



By Bob Brooks

It's been almost one year now since the August 2001 NovaChip demonstration project on SR 17 in the City of Soap Lake. I recently revisited that project to see how it's holding up after its first winter. As you may remember from the previous article last summer, the NovaChip process is an ultra-thin bonded wearing course intended for structurally sound pavements. The SR 17 project was the first project in Washington State to use NovaChip.

The surface preparation consisted mostly of sweeping and flushing; the NovaChip material went down quickly and produced a nice wearing surface of about $\frac{3}{4}$ of an inch in thickness. One of the most impressive aspects of the process and material was how quickly the roadway could be turned over to traffic, within 10 to 20 minutes with no damage whatever to the material.

So, how's it performing after nearly



a year? Well, as stated, I took a look at this project the first part of May and overall the pavement appears in good condition and seems to be performing as expected. Area maintenance personnel reported some minor reflective cracking during the winter months but no cracking was noticed during my short visit in May. It may prove interesting to observe this project at various times of the year to see what seasonal variations in surface conditions exist. The WSDOT Materials Lab is in the process of preparing a final report on this project and the report should be available soon. ▲



Securing the Roads

US Actions to Enhance Surface Transportation Security

A Reprint

By Vince Pearce, Transportation Specialist, FHWA

In the months following the terrorist acts of 11 September, intense effort has been focused on understanding the state of security of travel on the nation's roadways, and on improving the existing level of security. These efforts have taken place within and across modes and between agencies that had not previously had reasons to work together. The activity has encompassed agencies at federal, state, and local levels, as well as the private sector, academia, and many associations supporting these participants. Progress has been significant but not particularly visible. This article describes some of the effort, the findings, and the results.

Before 11 September, security of travel on the American roads received little attention. Some effort had been paid to security of transportation information systems (cyberterror), and a lot of useful experience had been gained in preparing for Y2K. Although the most visible impact of the events of 9/11 was on the nation's air travel, the surface transportation experiences in the New York and the Washington metropolitan areas were momentous. The US Department of Transportation (USDOT) was heavily involved on 9/11 and in the following

days, through its metropolitan offices in New York City and its division offices in New York state and the District of Columbia. One focal point has been USDOT's Crisis Management Center in Washington, DC, which has been operating around-the-clock since the first news of the terrorist attack arrived. The center has provided aid and assistance to those directly affected by the attack, and has not only kept the Administration informed on the state of transportation in the two metro areas, but also others around the country who responded to the potential threats on 9/11 and later.

In the days following 9/11, the Federal Highway Administration (FHWA), recognizing that a great amount could be learned from what was transpiring, commissioned the Volpe National Transportation Systems Center in Boston to prepare detailed case studies of surface transportation activity and impact in the two metro areas. Input for these studies has included material gathered from the media, internal agency assessments from participating agencies, and interviews with key participants. In the New York City case study, a detailed chronology of events is being compiled to understand the flow and impact of actions during and following the attack. The case studies, still under development, will be made available through the

FHWA Website when completed.

What We're Trying to Accomplish

FHWA's activities in surface transportation security are aimed at ensuring that surface transportation operating agencies throughout the nation have the necessary tools, techniques, information, and understanding to be able to prevent, prepare for, respond to, and recover from natural and man-made disasters. The goal is to have operational policies, protocols, procedures, practices, and improvements in place within each region that will enable people and goods to move safely and effectively during threatening situations while still enabling emergency access to the scene(s), and to facilitate re-establishment of transportation after an emergency.

In general, FHWA efforts seek to enhance, through awareness, guidance and technical assistance, the roadway (highway, arterials, etc.) transportation component of new and existing state and local emergency management planning and response efforts. More specifically, they are working to:

- More fully engage transportation operators with emergency managers and public safety in regional collaboration, information sharing, and strategic planning, for the management of

transportation during emergencies.

- Ensure development of a communications capability, with agreed-to protocols, standards, and messages, to enable transportation system operators to communicate with law enforcement, fire and rescue, EMS, and other emergency management officials.
- Ensure that transportation operation is an integral part of emergency management planning.
- Ensure that communications to the public, through media and advanced traveler information services, regarding the demands and conditions of the highways are an essential component of emergency management planning.
- Facilitate full information sharing and data exchange capabilities of the transportation system, including ITS, to support emergency management planning and operations.
- Ensure that planning for emergency management addresses issues surrounding the movement of freight, including the flow of supplies and materials to the emergency area(s) or site(s), and the restoration of the routine flow of goods and supplies to the general public.

At the USDOT policy level, DOT Secretary Mineta convened a National Infrastructure Security Committee (NISC) to execute pre-emptive, protective, and recovery efforts for the critical elements of the national transportation system, other than airports and aircraft. The NISC's role was to focus on non-aviation intermodal transportation security in coordination with DOT's goals of safety, mobility, economic growth, and environmental stewardship. The NISC was the Department's mechanism for

developing transportation security issues and policy proposals. The NISC requested that each Operating Administration (transportation mode) work with stateholders, partners, and service providers to identify high-value/high-consequence transportation facilities that may be targets for security fortification. FHWA has appointed a program manager for security, who serves as the focal point for all FHWA security activity. The program manager chairs FHWA's security integrated product team which contains representatives of each of the units within FHWA that has security-related activity.

Working in Stages

FHWA and related activity is best understood in stages, based on the structure in use by the Office of Homeland Security (OHS). This structure divides an emergency into six stages, chronologically: Detection; Preparedness; Prevention; Protection; Response; Recovery.

Detection

Detection most commonly involves collection and distribution of intelligence information. USDOT has been active in this area, particularly in assuring that intelligence moves between federal agencies and state/local ones, as well as 'bridging the gap' between transportation agencies and those in law enforcement and emergency management.

Transportation agencies themselves have a role in detection. FHWA is engaged in discussions, for example, with the American Association of State Highway and Transportation Officials (AASHTO), regarding what kind of materials would be helpful to highway maintenance workers, whose alert observations can provide critical and timely detection of possible wrongdoing. Similarly, the other modes at USDOT have begun

working with their state and local partners to identify how each employee involved in transportation can be an effective observer, and how to work with other state and local agencies (such as Highway Patrols) whose personnel are in a position to constantly observe the transportation infrastructure.

FHWA, working with ITS America, also has been keenly aware of the potential value of the existing and planned 'information infrastructure', or 'infostructure' created through ITS deployment, and the role it can play in monitoring activity on and around critical transportation infrastructure. FHWA has been working on defining desirable infostructure levels, based on various fundamental transportation characteristics.

Preparedness

Preparedness begins with effective and thorough planning, but it does not end there. Unless the plans are understood by participants, and practiced regularly, and unless the resources those participants need are available when and where they are needed, full preparedness cannot be achieved. To accomplish this, FHWA is working with AASHTO to survey the state of emergency management plans and to develop technical guidance on 'state-of-the-art' emergency planning for the new and emerging threat scenarios. There is a solid foundation on which this is being built, including the expertise at federal and state emergency management agencies, as well as the experience that transportation agencies have had in planning for emergencies such as hurricanes and earthquakes, and huge special events like Olympic Games.

FHWA, in support of regional emergency planning, is conducting three series of workshops in 2002. One series focuses on hurricane preparedness, a second on transportation supporting military mo-

bilization, and a third on response to and recovery from unpredicted events such as acts of terror.

In the last of the series, FHWA will be working with up to 10 metro areas and regions to bring together the many organizations involved in (or dependent upon) transportation at the time of an emergency, and working through two 'tabletop exercises' to identify areas in which preparedness can be strengthened. The Federal Transit Administration (FTA) is carrying out a comparable transit-oriented program in 15 additional locations around the country.

Prevention

Efforts in preventing further acts of terrorism are most strongly visible in areas such as freight movement and border crossings. FHWA's Office of Freight Management and Operations, in cooperation with the Federal Motor Carrier Administration, USDOT's ITS Joint Program Office, and the Department of Justice and Treasury, is working on three high-impact projects: Air Cargo Electronic Supply Chain Manifest, Electronic Seal System for Container Movement, and Asset Cargo Tracking. All three projects were originally designed to improve various aspects of freight mobility and efficiency. However, all three have as part of their design the ability to pinpoint location of freight assets and cargo based upon the latest reporting point.

The air cargo project, led by the American Trucking Associations Foundation, is designed to handle the chain of custody of cargo from its origination at a manufacturer/shipper to its end destination at the receiving air cargo facility or at the end destination curbside. En route, the originator, carrier and receiver of the goods use a smart card to hand off the freight between custodians. The smart card contains the biometric identifier of a thumbprint, the electronic manifest, and

an image of the driver's commercial driver license. All data is stored in a central server and is accessible through the Internet. The electronic seal project is designed to track containers in-bond from the point of inspection to the destination of the container, through seaports and across land border crossings. The e-seal is a radio frequency device that emits a signal as it passes reader devices, and will display information as to whether or not the container has been tampered with.

The asset cargo tracking project, led by the American President Lines in partnership with Union Pacific Railroad, PAR Government Systems and Transcentric, is designed primarily to track the chassis that containers ride on, anywhere in the United States. It also is designed for the chassis to know when a container is on it, and when it is tethered to a truck tractor. The information on location of chassis can be sent to a central data processing point by way of radio frequency identification (transponder), cellular signal or global positioning system signal (satellite). If the container is equipped with a transponder, the chassis-tracking device will read the tag and can convey cargo information to a central data processing point.

To assess benefits associated with employing these security elements, USDOT is using Border Wizard Pro as a tool. Border Wizard Pro was developed as a simulation tool for assessing border crossing improvements. The long-term objective is to link it to traffic management tools, like TRANSIMS, and assess the benefits of improvements along the highway that connect to marine ports as well as to land border crossings.

Protection

Protection activities have several different components. One area has been protecting the information systems upon which transportation

agencies depend to carry out their duties.

A second area has been protection during special events. USDOT has been an active partner and provider of expertise, most visibly in preparation for the 2002 Olympic Games in Salt Lake City. Although details have not been released regarding the specific measures implemented, transportation security was at heightened levels, and accomplished in ways designed to minimize impact on transportation effectiveness and assure that those affected had ample warning so that they could make appropriate travel provisions.

USDOT has developed and distributed to state DOTs a process that will enable state and local agencies to assess the threats to their critical infrastructure, and to take preventive measures. FHWA is working with AASHTO to develop a comprehensive survey of techniques to identify, assess threats, and to develop protection plans for critical transportation infrastructure. FTA has developed a technique specialized for transit agencies, and is funding its use at 33 of the largest transit agencies around the United States. FHWA also is working with AASHTO in discussions of fielding teams of experts to assist states in answering specific questions about critical infrastructure, with a particular focus on major structures such as bridges, tunnels, and interchanges.

Response

Response is typically defined as what is done starting at the moment of the emergency, for the remainder of that day, or for the following 24-hour period. Effective response is the core of the learning and exercises on the first of the two days of the FHWA response and recovery workshops mentioned earlier. Also, FHWA is working with AASHTO to develop technical material to help state and local agencies better

prepare for response, starting with a guidebook.

FHWA has been working with organizations involved in developing and deploying '511' telephone traveler information systems to understand how 511 (and other traveler information tools) support getting information to citizens at the time of an emergency, and how these systems are 'stressed' by the extremely high demands for information under those circumstances.

One particularly critical element in response is the ability of agencies to communicate with one another. FHWA's Incident Management workshop, implemented through the National Highway Institute, is being offered around the country to assist in bringing transportation and public safety (police, fire, and emergency medical) responders together to discuss and work on how to address incidents that occur on or that affect the transportation network. This emphasis was carried forward at the March 2002 Incident and Emergency Management National Conference in Irvine, CA.

USDOT's ITS Public Safety Program is sponsoring two national demonstrations of the integration of voice, data, and video communications between transportation agencies, fire and rescue agencies, law enforcement agencies, 9-1-1 call takers and dispatchers, emergency medical service providers and the towing and recovery industry.

Recovery

Recovery starts on the day following an emergency but can extend days and months afterward. During recovery, agencies work to re-establish safe, reliable, and secure transportation on the region's roads despite whatever damage may have occurred. Recovery is the focus of the second day of the FHWA response and recovery workshops.

FHWA has taken an active recovery role in support of those areas affected by the events of 9/11. One example was FHWA's actions to facilitate special size/weight permitting of the large equipment needed for recovery efforts in New York, as that equipment often traveled across several states to reach its destination. FHWA Divisions play a key part in processing state requests for emergency relief funds, a special category of federal-aid highway funding that can be available following a catastrophic failure of highway infrastructure due to an external cause. FHWA also is active in improving how transportation is carried out when areas, such as those contaminated by hazardous materials, must be avoided for an extended period.

A Real Example

Actions taken by the Virginia Department of Transportation's (VDOT) Smart Traffic Center (STC) in Arlington, VA, on 11 September demonstrate the importance of transportation operations and ITS during a national security event. VDOT's actions improved traffic flow, protected strategic locations, and supported delivery of emergency services.

High Occupancy Vehicle (HOV) lanes were reversed and opened to all traffic heading south away from Washington on I-395 and I-95. The area's state-of-the-art traffic signal system was quickly moved into its '4 July' mode to allow for maximum traffic flow out of the DC and Pentagon areas for those heading south and west to safety. VDOT's Northern Virginia District mobilized maintenance forces and implemented required lane closure plans. Contractors' crews were directed to stop work on roads in the region.

Variable message signs from other VDOT districts were brought in to assist traffic flow with emergency signage and detour information.

Area police were assisted by VDOT in inspecting all commercial truck traffic going through area tunnels.

Throughout the day and night, VDOT's Transportation Emergency Operation Center (TEOC) in Richmond continued to assimilate and distribute information to VDOT offices and other government units and to answer telephone calls from citizens inquiring about road closings and conditions. VDOT supplied continuous reports to the news media, and to Internet users via constant updates to its Web page.

Conclusion

Although a great amount has been learned and shared, and many actions have been or are being taken in response to what has been learned, we have much more to do. The surface transportation network is unique in the degree of its exposure and in its criticality to the nation's economy and the quality of life of its citizens. Fortunately, it is also highly redundant and resilient. The agencies responsible for the operation of this network are working together at an unprecedented pace, sometimes with very new partners, to ensure that all Americans can continue to rely on the transportation infrastructure.

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Strengthening Communication Between the Design and Construction Sections

*By Lynn M. Ross, Pierce County
Public Works and Utilities*

Recently I was fortunate to receive cross training between the Design and Construction Sections in Pierce County. I have worked as an engineer in the Design Section for the past five years and had an opportunity to work as a construction inspector for a five-month period last fall.

This was a very enlightening experience in which I learned quite a bit. It gave me a different perspective on the road projects that I will carry into my design work. I also valued the relationships that I formed with most of the other inspectors and the mentoring experiences they provided me.

During my employment with the Construction Section, I heard many frustrations voiced regarding why Design had chosen to do things a certain way. It was apparent to me that there was a need for improved communications between the two sections. If communications were better and the two groups knew each other better, Construction would probably be more likely to call and discuss the issues at hand.

The Engineering Division encompasses many different work sections. Each group plays a significant role in the development of an agency's road projects. The Design Section is responsible for the project throughout the beginning stages. The engineers in Design develop the scope of work and create detailed plans and specifications

to be used by a private contractor building the project.

The Construction Section takes over responsibility of the project once the design phase is completed and works with the contractor to ensure that the project is built exactly the way the designers intended. Most of the road projects are based on very similar details and use the same methods of showing information on the plans. For efficiency and a good product it is important that there be good communications between the two sections.

Proximity of offices can help or hinder interoffice communication on two fronts, easy accessibility and close working relationships. In the past few years the Design Section in Pierce County has strengthened its communication and working relationships with another Engineering Division section, Survey and Mapping. A big factor in their improved relations is that the two groups are located in the same building. Information exchanged between the groups is frequently passed back and forth in a very cooperative manner and ideas on how to improve coordination efforts are shared.

On the other hand, the Construction Section is located in a different building, separated from these two groups. Due to the separation, the interaction between Design and Construction is much more limited. Their communications are not routinely face-to-face. They are often restricted to telephone

conversations about conflicts with occasional meetings in the field. Many of the employees in each section do not know the employees in the other section.

In years past, "partnering" types of meetings between the Construction and Design Sections were held occasionally to provide feedback about the projects and involved a very large group of people. Unfortunately, they haven't been held for years.

Design and Construction currently hold an internal "pre-construction" meeting to discuss any issues that Design feels Construction should be aware of. The inspectors have always had this type of meeting with the Contractor before construction started, but this internal meeting between Design and Construction was just started a few years ago. This has seemed to improve the transition process from design to construction, but the communication efforts get stifled when the inspectors get reassigned to different projects.

I also noticed that the Construction Section would often need to make revision to improve things out in the field. This usually involved minor things and was not a big deal. If Design knew about these conflicts that arose in the construction phase, they could start incorporating this new knowledge into the projects to prevent the same conflict in the future. Although the inspector is required to do the "as-built" drawings once the construc-

tion phase is completed, the Design engineers do not always take the time to pull these out from the vault to see what had changed from their original design. Even if the Design engineers pulled the “as-built” drawings, they would not have an explanation for the changes.

As we have all learned, our work experiences and work products can be greatly improved by nurturing better communication among all workers. I believe that we can improve not only the *design* of road projects but also the *construction* of the roads. If the Design Section could get better feedback and suggestions from the Construction Section in a timely manner, they could create better road designs and clearer plans and specifications. In turn, the inspectors would enjoy working with these new “improved” plans and specifications and have more pleasant work experiences with the contractors.

I believe that the Construction and Design Sections can improve their “post-construction” communications by holding a meeting or at least by having the inspectors provide feedback during or at the end of the project construction phase.

I recommend that inspectors and engineers have an informal meeting to discuss the good and bad elements of the project either in an office environment or at the project site. The inspectors could either provide input on what worked really well and what they’d like to see in the

plans again or what changes need to be made to future plans. If inspectors are too busy during the construction season and time does not allow holding a meeting, they could provide written feedback to the engineers. It would still be preferred, though, that even a quick meeting be held at some point. This would allow explanations to be given if needed and the groups could get to know each other a little better.

I have developed a sample format for written comments, although any format of feedback would likely be appreciated. I thought that a simple format would work well with room to provide both the positive elements of the contract package and the elements that have room for improvement.

Of course, there is no need to wait until the construction phase is completely over to bring up comments. This could be done throughout the job at any point when a situation arises. Hopefully the two separate sections will get to know each other better and feel more at ease contacting each other throughout the whole project.

All in all, better communication is the goal. Your agency will benefit from this by putting out better road design projects and its workers will be more satisfied with their jobs! ▲



Sample

Pierce County Public Works and Utilities Transportation Services Engineering Division

CRP _____ Date _____

Project Name _____

Project Limits _____

Inspector(s) _____

Design Engineer(s) _____

Project Description _____

Things that worked well with this project _____

Things that could have been designed differently _____

Things that could have been detailed better or in a different way _____

Things that had to be changed in field from the Plans

Note: Please provide explanations and attach copies of change order, etc.

Living Longer and Better

By W. C. Evans, LTAP Manager, FHWA

We all make fitness and awareness of personal health somewhat a priority in our lives. I am no different, but was surprised by the findings of a health study in a news article. Health professionals nationwide developed this study.

Having been in the transportation field all of my career, I still did not realize that two of the top four items in the list would be transportation related and lead to better health and influence our longevity. Safety rather than fitness and health are at the top of this study.

More than 60 health and longevity affecting factors were listed. I am just listing the top 20 or so.

- | | |
|--|---|
| 1. Not smoking | 11. Maintaining a healthful weight |
| 2. Not smoking in bed | 12. Having blood pressure checked annually |
| 3. Wearing a seat belt | 13. Obeying the speed limit |
| 4. Avoiding driving under the influence of alcohol | 14. Controlling stress |
| 5. Living in a home with a smoke detector | 15. Consuming enough fiber |
| 6. Keeping a strong network of friends | 16. Restricting cholesterol |
| 7. Exercising regularly | 17. Getting adequate vitamins and minerals |
| 8. Moderating alcohol usage | 18. Seeing a dentist regularly |
| 9. Being careful to avoid accidents at home | 19. Restricting sodium |
| 10. Restricting dietary fat | 20. Restricting sugar |
| | 21. Getting 7 to 8 hours of sleep nightly (Hmmm...) |

Here is the best part – these are the things that we chose to do – or not to do. We have control of all of these things. We can put ourselves on the positive side of each of them.

As someone once said, “When you have your health, you have it all”!

King County Completes Significant Effort in Neighborhood Traffic Safety Program

By David Sorensen, WST2 Traffic
Technology Engineer

King County recently completed a major multi-year study to determine the effectiveness of traffic calming physical devices. The devices were placed on various residential streets in unincorporated King County in the late 1990's.

Expectations were to divert cut-through traffic back to the arterial system while slowing any remaining traffic, simultaneously achieving total customer satisfaction.

This study reviewed the "before" placement speed and volume data, and "after" construction speed, volume, and diversion data.

"The overall goal was to stem aggressive, speeding cut-through traffic in select neighborhoods while preventing diversion to nearby streets. We feel we met this goal beyond our own expectations," said Dave Paul, King County Senior Traffic Engineer.

In the mid - 1990's, the King County Road Services Division directed the Neighborhood Traffic Safety Program (NTSP) to pursue installation of traffic calming physical devices such as speed humps, traffic circles, and curb extensions as a direct response to increasing citizen demand for tools to deal with speeding traffic on residential streets. The NTSP responded by developing neighborhood selection

"The overall goal was to stem aggressive, speeding cut-through traffic in select neighborhoods while preventing diversion to nearby streets."

criteria and other administrative procedures for implementing the project. Having reviewed similar programs in other agencies along the west coast in the early 1990's, the NTSP established strict neighborhood qualifying criteria.

The qualifying criteria and program procedures resulted in identifying a small set of neighborhoods within a population base of approximately 500,000 King County citizens. All of the selected neighborhoods were plagued with cut-through traffic. The NTSP addressed only the most severe cut-through sites. These were neighborhoods in which all other efforts to change driver behavior had failed.

"Always include other impacted

agencies," Paul said. Fire districts, sheriff/police office, metro bus agency, and school districts should be involved right from the beginning. The fire district with operational responsibility in the area, for example, may view the subject roadway as a "primary response route" and strongly oppose the project. It is best to know this sooner rather than later.

Ten (10) project sites were examined. Before and after installation data was collected and analyzed for effectiveness for the devices in reaching speed or volume reductions goals and in producing wanted or unwanted traffic diversion. "Wanted" diversion occurred when unwanted volume on the neighborhood street was diverted back to the arterial road system. "Unwanted" diversion occurred when traffic was diverted off of the residential street(s) onto nearby or adjacent residential streets.

The most challenging issue is proper design. It cannot be done at a desk. The engineer must get into the field and repeatedly drive the streets, carefully selecting speed hump locations while keeping multiple factors in mind: driveway locations, cross streets, horizontal and vertical road curves, distances between humps, potential for diversion, and nearby destinations, just to name a few. To try to do this at one's desk is asking for certain failure.

Location Project Name	Percent Change at Selected Project Sites		Avg. Speed	85th % Speed	ADT
	Site No.				
Cascade Village	4		-29.2%	-23.3%	-59.8%
	6		-23.8%	-21.4%	-47.6%
Cascade Vista	12		-24.1%	-24.5%	-56.9%
	13		-20.0%	-19.1%	-44.5%
Cedar Creek	7		-29.7%	-26.0%	-9.8%
	9		-20.6%	-19.7%	-14.6%
Fairwood Firs	1		-57.4%	-52.8%	-60.3%
	3		-22.1%	-23.3%	-67.1%
Glenwood	5		-26.7%	-25.7%	-38.4%
	6		-28.6%	-26.4%	-33.4%
Juanita Estates	18		-36.2%	-18.0%	-41.7%
	19		-34.0%	-29.4%	-34.7%
Langston Lane	1		-30.0%	-26.5%	0.0%
	2		-28.4%	-24.7%	-2.4%
Queensgate	1		-10.8%	-11.7%	-25.0%
	3		-11.8%	-12.4%	-36.2%
South Spring Glen	16		-25.0%	-25.1%	-31.6%
	17		-24.0%	-22.3%	-31.0%
Tiburon Estates	1		-40.7%	-37.7%	-46.6%
	3		-21.4%	-16.5%	-46.8%

The overall results were favorable. The study showed that the physical devices produced an approximate 26 percent decrease in average speeds and about 24 percent decrease in the 85th percentile speeds. The study results show that speed humps can successfully be used in select residential neighborhoods to slow and/or divert traffic depending on the desired result. The

neighborhood selection and prioritization criteria functioned well for the agency and will be retained. This information will be very useful for showing neighborhoods why they fail to qualify for speed humps or other physical devices.

"The most rewarding aspect of this entire project is the knowledge that I now have a group of happy, smil-

ing neighborhoods out there that are now very protective of their speed humps," Paul said.

For more information on this study, please sssstudy please contact Dave Paul dave.paul@metrokc.gov (206) 263-6125, Senior Traffic Engineer, King County Road Services Division.



Neighborhood Selection and Prioritization Criteria

For Phase II Physical Devices King County NTSP Program

Measure	Range	Points
Traffic Volume	Up to 899 ADWT	Devices not permitted
	900 - 1,499	2
(Average Weekday Traffic: ADWT)	1,500 - 2,499	4
Special Note: In all Phase II projects, a minimum of 900 ADWT is required on the primary roadway at issue.	2,500 - 2,999	2
	Over 3,000	Devices not permitted
Cut-through Volume	25% - 40%	4
(As a % of the total ADWT on primary roadway between arterials.)	40% - 50%	4
	50%+	8
Traffic Speeds	1 - 4 mph over posted limit	0
(85th Percentile of all vehicles, both directions, following use of Phase I)	5 - 6	2
	7 - 8	4
	9 - 10	6
	11	8
	12+	10
Accident History	0.5 - 1.0 acc/year	1
(Reported collisions over past 3 years at intersections and mid block for study area)	1.1 - 1.5	2
	1.6 - 2.0	3
	2.1 - 2.5	5
	2.6 - 3.0	6
	Over 3.0	
Schools (Private or public schools — K through 12 only — on subject street)	within 1/4 mile	2
	between 1/4 & 1/2 mile	1
Other Pedestrian Generator (Park or Elderly Housing on subject street)	within 1/4 mile	2
	between 1/4 & 1/2 mile	1



Notes: The minimum number of points required for a neighborhood to qualify for consideration is 11. No physical devices will be placed on roadway sections having grades in excess of 10%. The final determination for qualification is made by the King County Traffic Engineer in accordance with applicable sections of the Revised Code of Washington (RCW), the Washington Administrative Code (WAC), King County ordinances, and current Road Services Division policy.

The Segway Human Transporter (HT)

*By Dave Sorensen, WST2
Traffic Technology Engineer*

The Segway Human Transporter is a two-wheeled "scooter" of sorts; only it is motorized and self-balancing (through the use of sophisticated computers, software, gyroscopes, and inclinometers). This human transport is a new type of transportation device that was developed by Dean Kaman from New Hampshire.

The Segway HT was developed in New Hampshire and publicized nationally; it has been shown on virtually all the major national news networks. Even President Bush has ridden this device and found it fascinating.

The New Hampshire legislature recently passed a law allowing the Segway HT to be ridden on sidewalks in New Hampshire.

Though this is truly an innovative device, how it will affect safety on our roads and sidewalks is still an issue with many state and local agencies.

The Segway HT can travel up to 12.5 MPH, about the average speed of most bicycles. It has no breaks and literally moves at the leaning of your body. "Dynamic



Stabilization" enables Segway HT to work seamlessly with the body's movements. Gyroscopes and tilt sensors in the Segway HT monitor a user's center of gravity at about 100 times a second. When a person leans slightly forward, Segway HT moves forward. When leaning back, Segway HT moves backward. The more you lean in one direction, the faster it goes in that direction (it requires the twisting of the hand grips to make it turn).

The law passed in New Hampshire does not classify the segway as a vehicle - in fact, it specifically says that the Segway shall not be considered a vehicle. So unlike bicyclists, Segway riders do not have to obey vehicle traffic laws.

Since the Segway HT is not scheduled to be ready for retail sale until this fall, very few people have been able to ride one and determine how it works, what its limitations are, and what are its operating characteristics.

The benefits of the Segway HT may become far-reaching, including the creation of more livable communities. In time, the Segway HT could lead to a reconfiguration of the way communities are built by significantly extending people's walking zones, thereby enabling better use of space and the transportation infrastructure.

As the Segway HT becomes popular, municipal agencies across the country will be taking a close look at the political and social currents of this new device. ▲

Evaluation of Virginia's First Heated Bridge

Reprinted from VTRC 01-R8RB,
March 2002

Need an icebreaker? Try a Heated Bridge...

Driving in snow and ice is no fun. This is especially true on bridges, which freeze before the roads because of the open air under them. Traditional ways to improve driving conditions on bridges are to push the snow off to the side, apply salt to melt the ice, and spread sand to increase traction. These methods have varying success. In addition, deicing salts are harmful to concrete and steel structures, such as bridges. Now, an advanced technology might improve safety on bridges during icy weather in a new way: heating the bridge deck to prevent snow and ice from forming.

One result of the 1991 Intermodal Surface Transportation Act was the formation of the federal Applied Research and Technology Program, designed to accelerate testing and evaluation of new technologies. The Heated Bridge Technology Program provided for reimbursement of 80% of the construction costs and 100% of the planning and evaluation costs on a heated bridge project. Virginia was one of only five states that responded to the program.

Now, an advanced technology might improve safety on bridges during icy weather in a new way: heating the bridge deck to prevent snow and ice from forming.

In 1995, under the provisions of the program, the Virginia Department of Transportation (VDOT) began constructing a two-lane heated bridge on Route 60 over the Buffalo River in Amherst County. The site is in the eastern foothills of the Blue Ridge Mountains, where road conditions during winter storms are often treacherous. The bridge is 117 feet long and 44 feet wide. Construction was completed in the summer of 1996 at a cost of \$664.9 thousand, including \$181.5 thousand for the heating system.

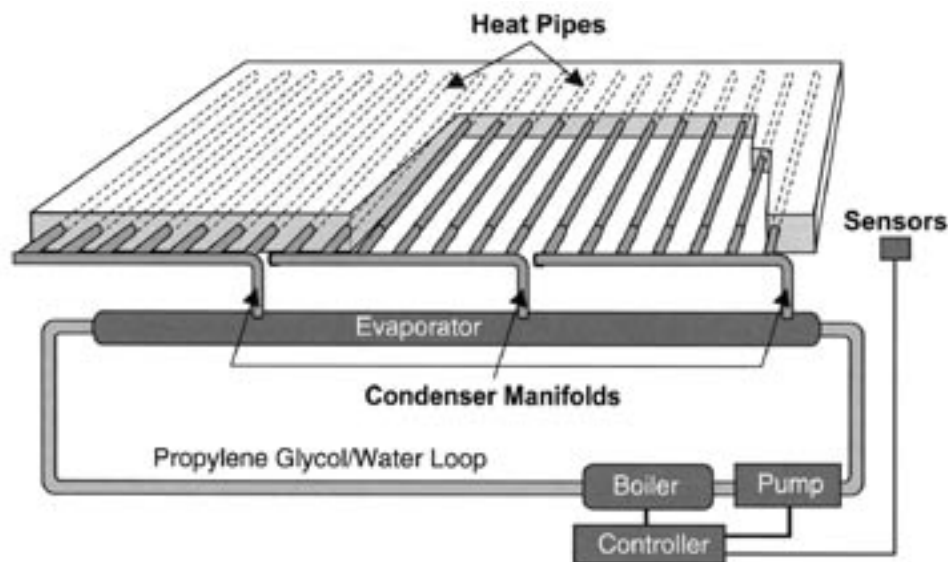
Our research team evaluated the operations and efficacy of the bridge through 2001.

The Heating System and How it Works

The anti-icing heating system was designed and fabricated by SETA Corporation of Laramie, Wyoming. It is one of several currently available heated bridge deck technologies. The project contains approximately 2 miles of steel piping, including 241 heat pipes embedded in the concrete deck and approach slabs. The pipes are ½ inch in diameter, spaced 7 to 9 inches apart in the transverse direction.

The pipes were originally filled with Freon HCFC 123. However, the resulting heat output was proven inadequate, as determined by the monitoring equipment installed at the bridge. Various remedial measures followed, including experimentation with ethanol and Freon 134a as alternative heating media. In January 1999, ammonia was successfully used as the medium.

As shown in the diagram on the left, a furnace fired by propane gas heats a mixture of propylene glycol and water. This antifreeze mixture circulates through a separate piping loop to evaporators, heating the ammonia in the heat pipes. The bridge is tilted slightly so that one end of the pipes is higher than the other. As the fluid boils, vapor rises in the heat pipes from the lower



Schematic of heat pipe system.

to the higher end and warms the bridge deck. As the vapor cools, it condenses and trickles back to the evaporators, where it is reheated. A computerized control system continuously receives information from various sensors and automatically activates the heating cycle when specific conditions are met.

Any of three conditions can activate the system: (1) the deck surface sensor indicates snow or ice, (2) the precipitation sensor indicates the presence of precipitation and the temperature of the deck surface is below 35°F, or (3) the deck surface sensor indicates a wet deck and the surface temperature is below 35°F.

Conversely, either of two conditions will shut off the system: (1) the deck surface sensor indicates a clear surface for more than 10 minutes, or (2) the temperature of the deck surface is above 40°F.

What We Learned

Although the heat pipe technology can be used effectively to prevent snow and ice accumulation, a reliable deck heating system is still a work in progress. More robust controls need to be developed by the industry so that the failure of a single sensor cannot disable the entire system.

Perhaps more important, an active and essential mechanical system requires a substantial effort in terms of time, personnel, and expertise to ensure that all components are functioning safely and effectively.

The proper selection of the working fluid is critical to the satisfactory operation of the heating system. It is evident that ammonia offers a much higher heat-carrying capacity than the Freons.

From a technical standpoint, the use of a heat pipe system offers advantages over an electrical or hydronic system. A smaller hydraulic pump can be used, and in the event of leakage, the system can be readily accessed for repairs. It is important to place the primary loop of the system outside the deck. In this way, if working fluid were to leak from a heat pipe, the loss of coverage would likely be limited to the area served by only one evaporator.

The heat pipe system also offers an economic advantage, with lower operating costs. Combined with an annual maintenance cost of \$500, the total operating cost for the Route 60 bridge is estimated to be approximately \$3,500 per year. In contrast, the operating costs of the closest alternative hydronic system was initially estimated at \$6,000 per year.



Recommendations

- Make the control system redundant; the failure of a single sensor can cause the entire heating system to become inoperable.
- Place the deck surface sensor on the bridge deck, as its location is critical to the proper operation of the heating system.
- Use infrared scans to ensure uniformity of the heating system prior to granting final acceptance.

About the Researcher

Ed Hoppe is a Senior Research Scientist in VTRC's Structures, Pavement, and Maintenance Group. He earned a Ph.D. from McGill University in Montreal and is a registered Professional Engineer in Virginia. Ed came to the VTRC in 1993, and his interests are in geotechnical research. He is an active member of several professional organizations, including the American Society of Civil Engineers and TRB's Committee on Soil and Rock Instrumentation, and is a U.S. representative on the World Road Association's (PIARC) Committee on Earthworks, Drainage, and Subgrade.

Want the Whole Story?

If you'd like a copy of the full report, please E-mail VTRC's Media Center at vtrcmedia@vdot.state.va.us and ask for:

Evaluation of Virginia's First Heated Bridge VTRC Report No. 01-R8

The report may also be downloaded from our website at <http://virginiadot.org/vtrc/>.

If you have questions about the research topic, call Ed Hoppe at (434) 293-1960. ▲

Boosting Roadway Safety with Rumble Strips

Reprinted from FOCUS, May 2002

Approximately one-third of all traffic fatalities and serious injuries in the United States annually are due to run-off-road crashes. In 2000, almost 16,000 deaths were attributed to these types of accidents. Such statistics have caused the transportation community in recent years to take steps aimed at keeping motorists on the road, rather than relying on clear roadsides and traffic barriers to minimize crash severities. On answer: rumble strips. Richard Powers of the Federal Highway Administration's (FHWA) Office of Safety Design says, "Our primary goal is to reduce single-vehicle crashes and fatalities, and rumble strips have proven to be a cost-effective way to keep motorists on the roadway."

Rumble strips are raised or grooved patterns constructed primarily along paved shoulders. When vehicle tires pass over the strips, they produce a sudden rumbling and vibration in the car. Both the sound and the vibration alert fatigued or distracted drivers that they are beginning to drift off the road.

FHWA is spearheading a movement to increase nationwide use of rumble strips. A new technical advisory released by FHWA in December 2001, *Roadway Shoulder Rumble Strips*, contained the latest information on the state-of-the-practice design and installation of rumble strips, including recommendations for minimizing the adverse effects rumble strips may have on bicyclists using roadway shoulders. The advisory, which also includes an extensive list of reference materials on rumble strip use

and effectiveness, is posted on the Web at www.fhwa.dot.gov/legsregs/directives/techadv/t504035.htm.

Numerous states have performed studies on the effectiveness of rumble strips, with the resulting statistics revealing dramatic success rates. In 1985, the California Department of Transportation (DOT) performed a before-and-after study where it installed rumble strips along sections of Interstates 15 and 40 in San Bernardino County. The study revealed a 49 percent decrease in the number of run-off-road crashes in the areas with rumble strips. Recent follow-up evaluations of freeway segments where shoulder rumble strips have been in place for 3 or more years have shown a 33 percent average reduction in run-off-road accidents.

In the early 1990s, Pennsylvania performed an extensive review of the effectiveness of shoulder rumble strips. As part of this project, the Pennsylvania Turnpike developed a shoulder rumble strip that it called the Sonic Nap Alert Pattern (SNAP). Following the installation of SNAP, the monthly number of run-off-road accidents decreased by 70 percent. A report on the project can be viewed on the web at fhwa.dot.gov/safety/fourthlevel/rumble/state_penn.htm.

The Delaware DOT's US Route 301 Centerline Rumble Strip project provides some of the most compelling evidence concerning the success of rumble strips. After experiencing a high fatality rate from head-on collisions on Route 301, the Delaware DOT installed centerline rumble strips along the road-

way. The result was a 90 percent decrease in the head-on collision rate and a zero fatality rate. These improvements were achieved despite a 30 percent increase in traffic. The project was awarded one of the 2001 National Highway Safety Awards by FHWA.

In addition to increased safety, rumble strips have been shown to cut costs. Several states have analyzed the benefit/cost ratio of shoulder strips, and the results are as dramatic as the accident reduction rates. New York State Thruway data indicates a benefit/cost ratio ranging from 66:1 to a high of 182:1. The Nevada DOT found that with a benefit/cost ratio ranging from 30:1 to more than 60:1, rumble strips are more cost-effective than many other safety features, including guardrails, culvert-end treatments, and slope flattening. And a Maine DOT survey of 50 state DOTs identified a benefit/cost ratio of 50:1 for milled rumble strips on rural Interstates nationwide.

Looking at the future, to build on current rumble strip successes, additional installations and evaluations of centerline rumble strips and shoulder rumble strips on two-lane rural roads are needed.

For more information on using rumble strips, contact Richard Powers of FHWA at 202-336-1320 (E-mail: Richard.powers@fhwa.dot.gov) or visit FHWA's Rumble Strips Web site at safety.fhwa.dot.gov/programs/rumble.htm. ▲

Design Guide Offers New Look at Mitigating Highway Rockfall Hazards

Reprinted from FOCUS, May 2002

Each year, rockfalls along highways costs states millions of dollars in claims and litigation. Even worse, several states have reported injuries and deaths as a direct result of rocks falling onto roads. According to Oregon Department of Transportation (DOT) Geotechnical Designer Don Turner, "In Oregon in the last 20 years, anywhere from 5 to 8 people have been killed and 10 to 20 have been injured [due to highway rockfall]. Even more common is property damage to vehicles when a rock hits a windshield or rolls in front of a car that swerves out of the way and hits a tree. Many of the smaller incidents aren't even reported."

To address this hazard, highway agencies design "catchment areas," which are ditches along the side of the road that channel falling rocks away from vehicles. To date, catchment areas have been used inconsistently throughout the United States because not enough research had been done to provide engineers with the data they need to make informed design decisions. A new design guide available from the Oregon DOT is stepping in to fill this gap.

Oregon DOT recently completed a pooled-fund study with the Federal Highway Administration and seven other state DOTs, the results of which have been published in the



This photo shows a rockfall catchment area.

new *Rockfall Catchment Area Design Guide*. The *Design Guide* details the study's test methods, fieldwork performed, means of analysis, and research results, and presents catchment design charts for practitioners in a user-friendly form.

To gather data for the report, a team of researchers rolled more than 11,000 rocks off 4 different rock cut slopes of 3 different heights. The rocks were rolled into three different catchments. A large number of rocks were needed because of the high number of testing variables; the rocks ranged in size from .3 m (1 ft) to .9 m (3 ft) in diameter and were rolled 12 m (40 ft), 18 m (60 ft),

and 24 m (80 ft) down any of four slopes (with angles ranging from 45 degrees to almost 90 degrees). The rocks were rolled into one of three different catchments (with angles ranging from 0 degrees to about 14 degrees). Researchers then plotted a series of charts that depict the size of the catchment needed based on the different combinations of factors. For instance, if an engineer needs to create a catchment for a 24-m (80-ft) high slope at a nearly 90 degree angle, a *Design Guide* chart will show that a 4.5-m (15-ft) wide ditch is needed to retain up to 90 percent of falling rocks.



The top photo shows a 24-m (80-ft) high test site.

The photo above shows rocks as they are dropped by an excavator from a 12-m (40-ft) high slope.

In addition to catchment charts and guidelines, the *Design Guide* offers step-by-step guidance on applying the catchment design procedure using sample problems and highway project case studies. The case studies also demonstrate other design considerations such as constructibility of the catchments and cost/benefit comparisons of alternate designs.

The *Rockfall Catchment Area Design Guide* can help transportation agencies in several ways. Even with an engineering concept as simple as a ditch, it takes significant effort to determine how wide it should be to ensure maximum safety from falling rocks. The Guide takes much of the guesswork out of designing a catchment, thus saving states and localities time and money. Another advantage of using the *Design Guide* is that it can

help determine the potential effectiveness of existing catchments without an agency having to conduct tests on each one individually. And ultimately, the advice given in the Guide can help make traveling through areas with rock slopes far safer for drivers.

An electronic copy of the *Rockfall Catchment Area Design Guide* is available on the Oregon DOT Web site at www.odot.state.or.us/tddresearch/reports.htm.

For more information on the *Design Guide*, contact Liz Hunt, Technology Transfer Coordinator at Oregon DOT, 503-986-2854 (fax: 503-986-2844; E-mail: Elizabeth.a.hunt@odot.state.or.us). ▲

Jack Moltz's Under Guardrail Cleaner



*By Dave Sorensen,
WST2 Traffic Technology Engineer*

Highway maintenance operations take a lot of time and effort, and often can be hazardous duty. Cleaning under guardrails is no exception. Removal of roadside debris comes with exposure to traffic. Closing a lane on already overcrowded highway sets the stage for rear end collisions, impeding the traffic stream, and air quality degradation.

Because Jack Moltz, WSDOT Chehalis Maintenance, is always looking for a "Better Mousetrap" and safer ways to do his work, he developed the under guardrail cleaner. Jack took his idea to Bob Steel of the Transportation Equipment Fund (TEF) shop who fabricated the tool. Daryl Sprague, also from WSDOT Chehalis Maintenance, had the pleasure of operating the mini excavator with the tool attachment for a trial run. "We were impressed," Jack said.

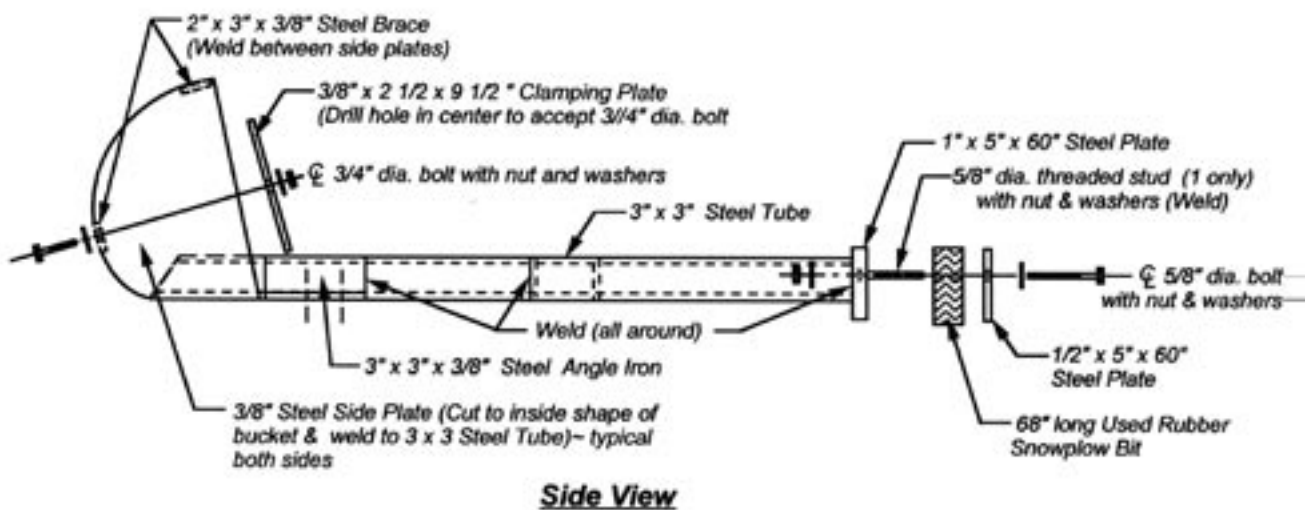
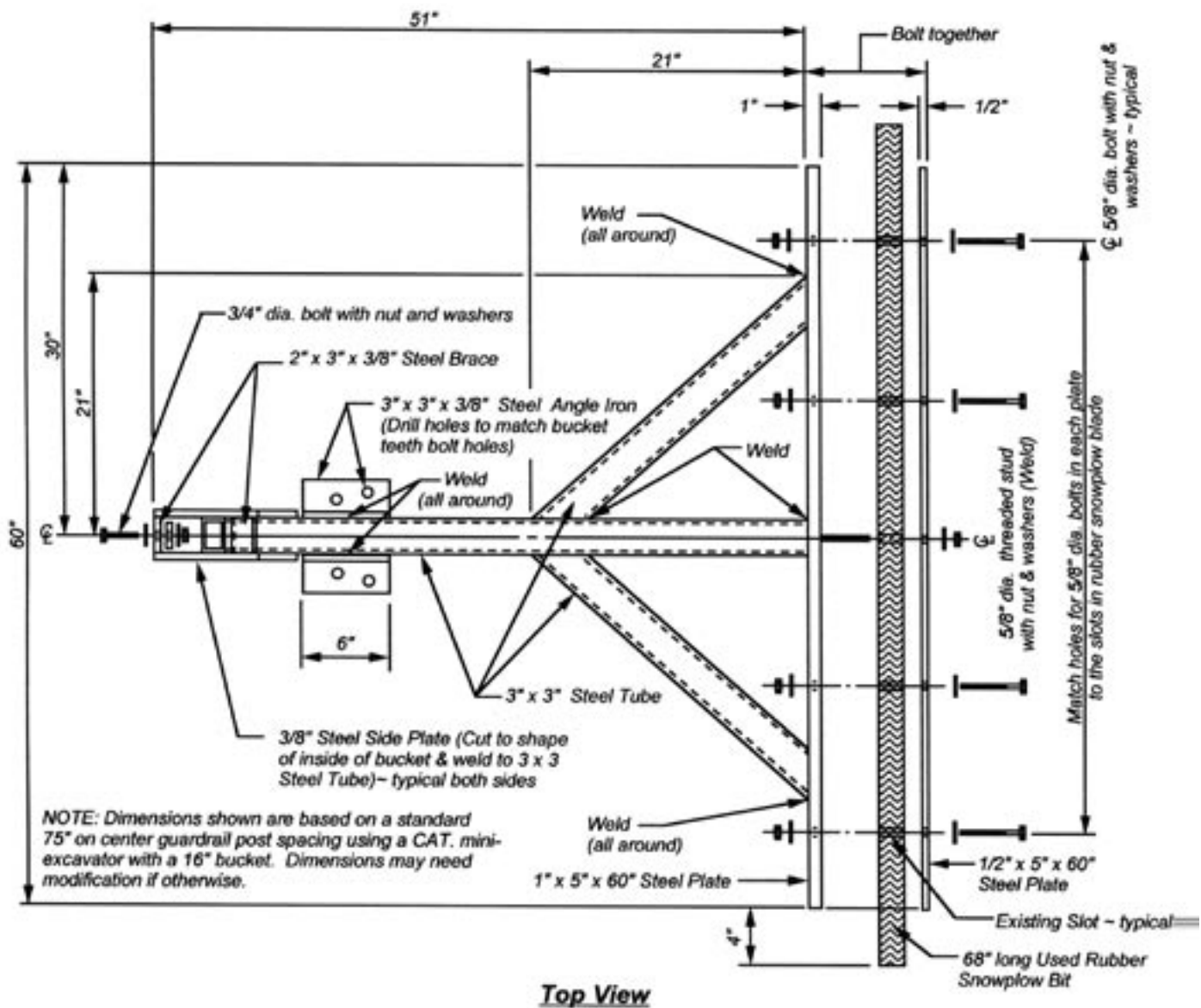
With the old hand shovel method, a crew of eight could cover about 1000 feet a day and that required a lane closure on I-5 at night. The section of I-5 Jack and crew work on has only two lanes in each direction so a lane closure can back up traffic quickly.



Photo top left: Jack Moltz and his Under-Guardrail Cleaner.'

Photo top right: Cat Mini -excavator with a 16" bucket.

Photo above: The connection fits inside the excavator bucket and is bolted through existing holes for the bucket teeth and another in the back of the bucket.



Using this new tool, a 3-member crew can accomplish over a mile with only a shoulder closure during the daytime operations. The savings really adds up in reduced labor, equipment, societal cost of traffic delays and enhanced employee safety. The tool also extends the useful life of snowplow bits with another function. The tool was inexpensive, costing about three hundred dollars to build. "This has proven to make the job very easy and fast. It has saved time and money," Moltz said.

For more information, questions or comments, please contact Jack Moltz, WSDOT Chehalis Maintenance, at (360) 748-2181. ▲



Photo top right: Bolt locations match existing holes in the bucket for mounting teeth.

Photo middle left: A worn out rubber snowplow blade is sandwiched between 2 steel plates.

Photo middle right: The width of the unit allows raking between the guardrail posts in one pass.

Photo to left; The under-guardrail cleaner is simple to build and very effective.





*The
"Better Mousetrap"
is awarded each quarter
for the most innovative
working ideas presented
by a public agency and
published in WST2.*

Award:

The best concepts will be published in the WST2 and posted on the WST2 Web Page.

Published mousetraps will receive a "Better Mousetrap" baseball cap and certificate.

Published mousetraps will be included in competition for the annual "Crystal Mouse" award.

Eligibility:

Washington State Public Agencies.

Mail To:

"Better Mousetrap"
WST2 Center/WSDOT
P.O. Box 47390
Olympia, WA 98504-7390

E-mail:

WST2Center@wsdot.wa.gov

For questions:

Dan Sunde,
Technology Transfer Engineer
SundeD@wsdot.wa.gov
(360) 705-7390

"Better Mousetrap" Submittal Form

Agency: _____

E-mail Address: _____

Address: _____

City: _____

State: _____

Zip+4 _____

Phone Number : () _____

Developer's Name(s): _____

Title: _____

Agency: _____

E-mail Address: _____

Address: _____

City: _____

State: _____

Zip+4 _____

Description of the "Better Mousetrap"

Why was it necessary? _____

How does it work? _____

How was it built? (Include Sketches, Photos, Drawings) _____

How does it perform? _____

Please add a sketch with dimensions and materials used!
We will draw plans from them so others can build it too!

WSDOT Aberdeen Maintenance Culvert Cleaning and Relining Process



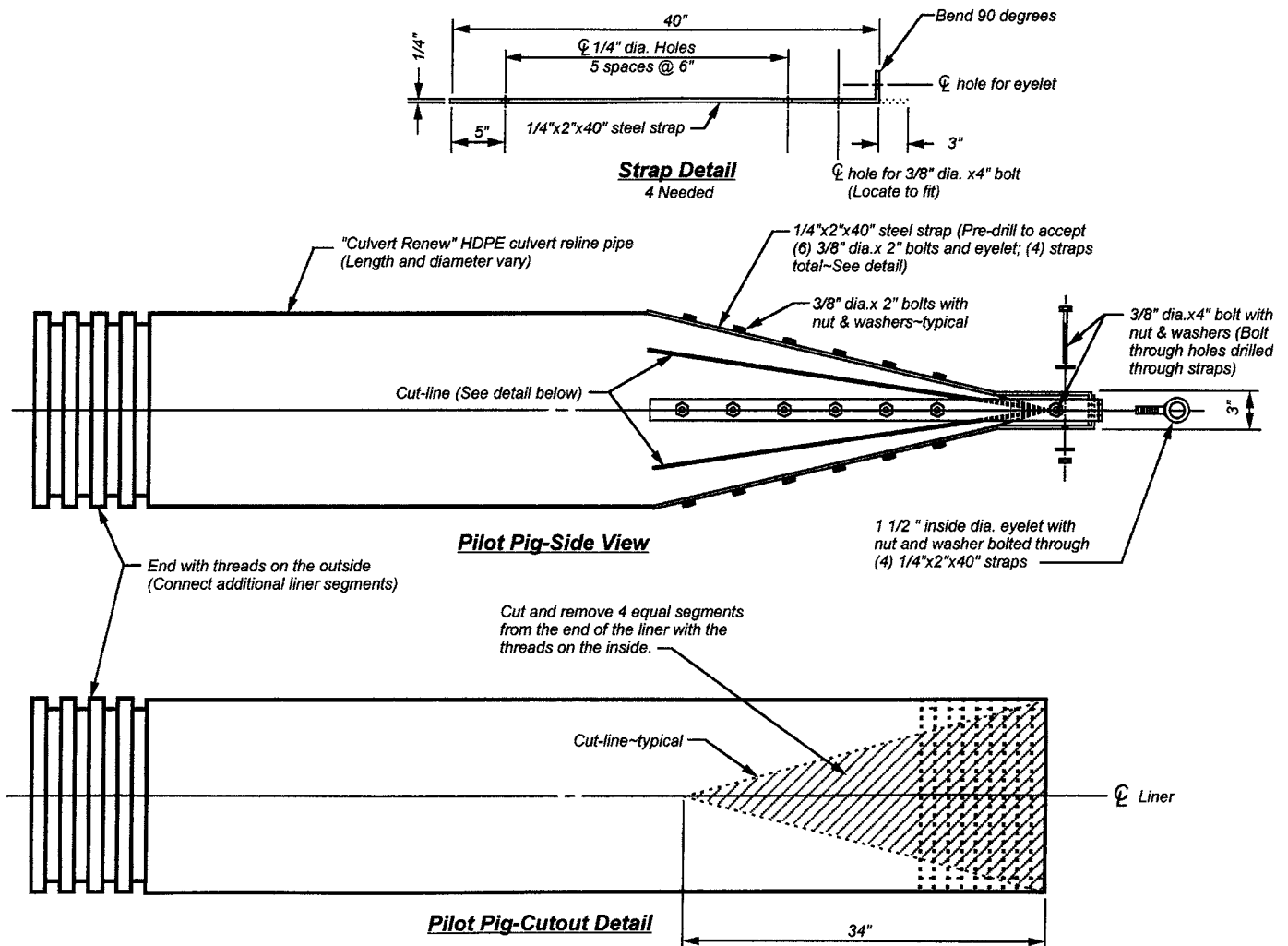
"Don Wright, Gregg Schmitz, and Ernie Shumate (left to right) display their culvert cleaning pig"

The Story of the Three Little "Pigs"

*By Bob Brooks, WST2 Pavement
Technology Engineer*

Several crewmembers from the Washington State Department of Transportation's (WSDOT) Aberdeen Maintenance Office in the Olympic Region have devised a very effective method for cleaning and relining culvert pipes. The cleaning "pigs" can be used independently as a cleaning tool or in preparation for the relining process. The crew has repaired several 24-inch culverts with scour damage using this process.

Supervisor Ernie Shumate, Lead Tech Keith Teeter and Crewmembers Gregg Schmitz, Don Wright, Randy Moody, and Joe Shapansky developed the idea for the cleaning "pigs". They built the devices in about four hours for very little cost using scrap material they had on-hand. The cleaning "pigs" are actually two separate tools used together to accomplish the culvert cleaning.

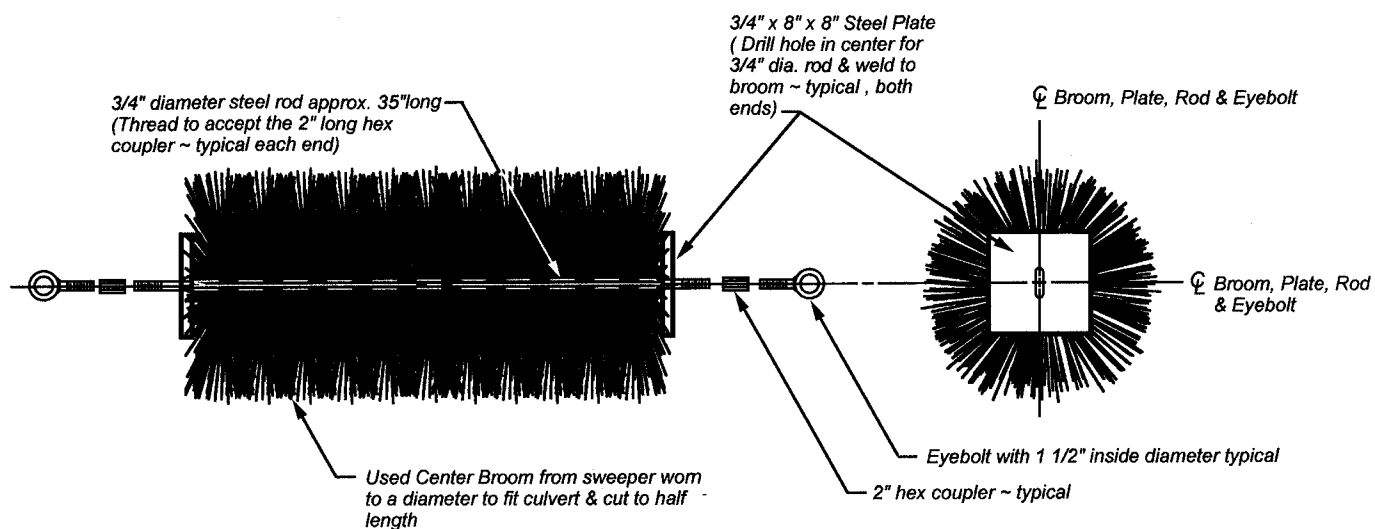


The First Cleaning "Pig"

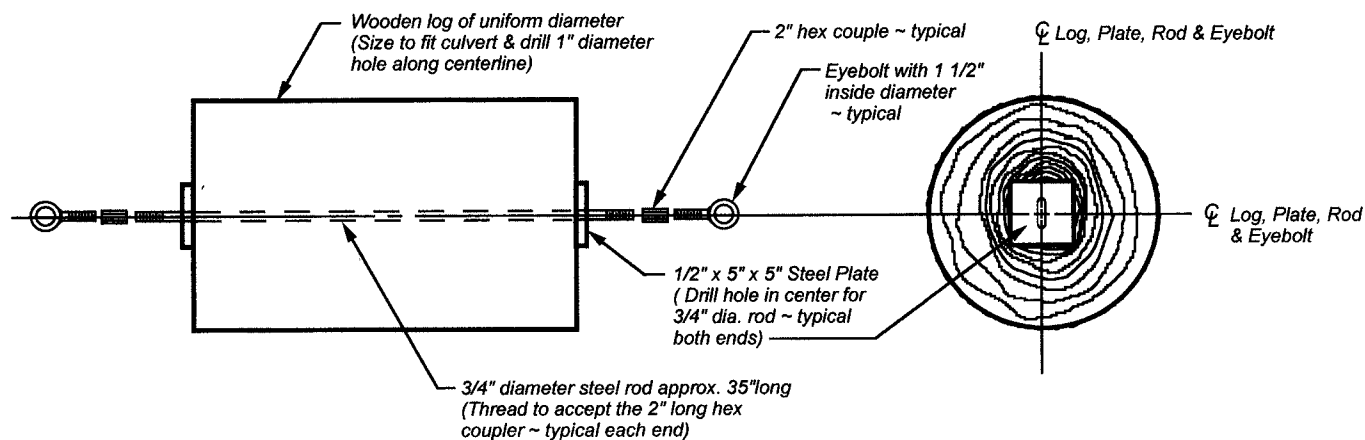
The first cleaning "pig" was fashioned from the center broom of a pick-up sweeper. The broom is allowed to wear down to an appropriate size for the intended culvert to be cleaned; for the 24" culverts the broom was allowed to wear to approximately 21" - 22" in diameter. The broom was then removed from the sweeper and cut in half to create a handy, workable length of around 31". Quarter-inch steel plates, with holes sized to pass a 3/4" rod through the center, were then welded to each end of the broom. A 3/4" diameter threaded rod was then inserted through the broom and plates, a threaded coupler was attached to both ends of the rod, and eyelets were attached to each of the couplers.



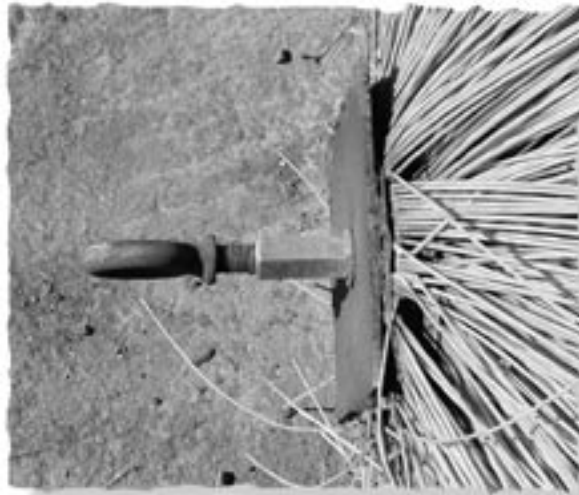
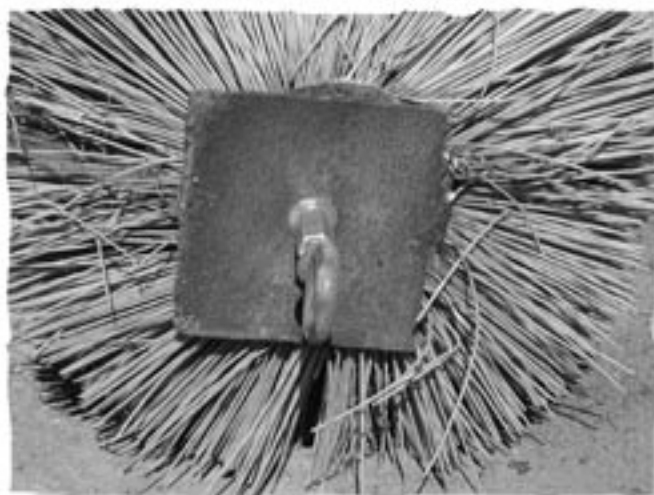
"Center Broom From Sweeper - Culvert Cleaning Pig"



Cleaning Pig #1



Cleaning Pig #2



"Center Broom From Sweeper - Culvert Cleaning Pig"



"Wooden Culvert Cleaning Pig"

The Second Cleaning "Pig"

The second cleaning "pig" was made from a 24" section cut from a tree with a uniform diameter to fit the diameter of the culvert to be cleaned. For the 24" diameter culverts, the pig diameter was again approximately 21" - 22". As with the broom, the wooden log section was drilled, a 3/4" diameter threaded rod was inserted through the center, and eyelets were attached to the ends of the rod.

The Cleaning Process

To accomplish the culvert cleaning, a steel cable is threaded through the culvert using a series of metal plumbing pipes screwed together. An excavator and wood block are used as an anchor point and the cable is drawn around the block and attached to a pickup truck. This setup allows for a straight pull of the cable through the culvert pipe. The broom is then attached to the other end of the cable. Another steel cable is attached to the opposite end of the broom to allow the "pig" to be pulled back out if it gets stuck inside the culvert. The pickup then draws the broom through the culvert.

By starting the cleaning process using the broom, the bigger pieces of debris are removed first. Next, this same process is repeated using the wooden "pig" which completes the cleaning process and prepares the culvert for relining if needed.



"'Culvert Renew' Modified Culvert Relining System"

The Relining Process

The relining process involves pulling a pilot "pig" through the culvert in a similar manner as the cleaning "pigs" and connecting additional sections of liner as needed. Once the pilot "pig" has towed the complete liner into place, it is disconnected and reused.

The relining process utilizes a very specialized culvert pipe called "Culvert Renew" manufactured by Poly Profiles Technology, Inc., Missouri. This pipe is designed specifically for culvert relining and comes in various diameters common to culverts and in lengths of 5, 10, and 20 feet. Each section of the smooth bore, high-density, polyethylene pipe is manufactured with threaded male and female ends that allow the sections to attach to form a contiguous section for the relining process.

What the Aberdeen crew did was design a pilot by modifying a section of the standard pipe. They took a section of this pipe and divided the female end into equal quadrants. Each quadrant was cut back to a single point about 34" into the pipe in a triangular shape and removed. A steel strap measur-



ing 1/4"x2"x40" was then bolted onto each of the four remaining triangular pieces of pipe in line with the centerline of the pipe. The straps were bent 90 degrees 3" from the end so that they overlapped to form a square approximately 3"x3" when they came together at the end. An eyelet with a 1 1/2" inside diameter was then bolted through a hole in the straps where the four straps overlapped.

As with the cleaning pigs, a steel cable is attached to the eyelet and the modified "Culvert Renew" pipe is then drawn into the culvert to be relined. When needed, an additional relining pipe segment is screwed onto the first segment and then drawn further into the culvert. This process is repeated until enough length has been towed into place to fully reline the existing culvert pipe. When sufficient length is in place, the cable and first pilot pipe segment are removed. The remaining ends of the new liner can then be beveled as needed to fit the existing culvert profile.

The "Culvert Renew" pipe, sized to reline a 24" culvert costs about \$480 per 20' length, \$270 per 10' length, and \$150 per 5' length. While this might seem expensive, this has proven to be an effective system that allows the maintenance crew to clean and reline a culvert, a process that would have previously required a contract to accomplish. ▲

2002 Partnerships for Quality Transportation (PQT)

Making A Difference Awards Presented

The PQT Making A Difference Awards were presented by Kevin Dayton, Washington State Dept. of Transportation Construction Engineer and PQT Steering Committee member, on May 21, 2002 at the Public Works Week Luncheon at Harborside Restaurant in Seattle, WA. PQT unites government agencies and private industry groups, enabling them to work together to achieve their common goal - quality transportation and customer satisfaction.

The I-5 Interstate Bridge Decks project won the PQT Partnering Award. This project provided for the improvement of I-5 in Pierce County, WA by repairing and protecting two bridge decks: the Bridgeport Way structure and the Gravelly Lake Drive structure. The project called for a one-time, seven-day continuous closure of the Bridgeport Way structure. To accomplish this incredible task, a partnership was formed between Washington State Department of Transportation and Concrete Barrier, Inc. during the pre-construction meeting and maintained throughout the life of the project.

*Project Contact: Fred O. Tharp,
WSDOT Tacoma Project Office, (253)
534-3101*

The SR 97A Lakeside Vicinity Project won the PQT Breaking the Mold Award. This project provided for the improvement of a ½ mile section of Highway 97A by widening the roadway to accommodate the addition of a two-way left turn lane, overlaying the roadway with Asphalt Concrete Pavement, updating the existing storm sewer system, and adding illumination. The end result is a project of very high quality, constructed on time and under budget, completing the improvements of multiple entities with the least impacts and costs to each customer, partner, and the community as a whole.

*Project Contact: Terry Berends,
WSDOT North Central Region
Project Office, (509) 667-2880*

Both the I -5, Interstate Bridge Decks project and the SR 97A Lakeside Vicinity Project were submitted to the National Partnership for Highway Quality (NHPQ) as nominations for their 2002 Making A Difference Awards, which will be awarded later this year. ▲



Team Effort Produces Positive Results in Southeast Washington

By WSDOT Eastern Region Local Programs

Driving through the recently renovated portions of SR 27 and SR 272 in southeast Washington, a passerby would not guess that just two years ago the small community of Palouse, in the midst of Washington Wheat County, was faced with the vast problem of funding the repairs and reconstruction desperately needed for local roadways and adding a spark to a downtown area that was in need of economic revitalization. Due to the result of years of community planning and the teamwork of multiple state and private organizations, the East Main Street/SR 272 project is a major success, demonstrating the positive outcomes of partnerships in the spheres of both financial resources and project planning.

The city of Palouse recognized the value of utilizing partnerships with local citizens and multiple regional and statewide agencies. Not only did the roadway infrastructure need significant repairs and improvements for safety and function, but all parties involved also wanted to add enhancements to the route to promote a sense of community and encourage further economic development in the area. What resulted was a \$2.5 million infrastructure enhancement project that encompassed most of downtown Palouse. Combining

a WSDOT maintenance project planned for the area and a city plan for renovation of East Main Street (SR 272), resources were used efficiently to produce the best results. WSDOT helped guide the city of Palouse in finding additional funding resources that would allow the city to also upgrade SR 27 within the project area.

The multi-agency and multi-jurisdiction project team implemented a plan that was effective and comprehensive due to the immeasurable input of a variety of resources. The project team consisted of folks from the city public works and city administration departments, the city's consulting engineering firm, WSDOT Eastern Region, and the private construction company hired to do the project; all working together throughout the entire design and construction process to create the most complete project possible.

The city of Palouse is grateful for the dedicated teamwork and input of these partnerships, noting "without their assistance, we could not have designed the most effective, comprehensive, set of street improvements for a community our size...or even have been able to fund the improvements." The transportation enhancements make SR 27 and SR 272 safer routes for motorists and the community more inviting and attractive for visitors.

Project planning and funding were the result of a team effort of the following agencies and organizations:

- WSDOT (Eastern Regional Office)
- Federal Surface Transportation Program
- Federal Rural Economic Vitality Program
- Transportation Improvement Board (small cities account)
- City of Palouse and community members
- Whitman County Public Works Department
- Palouse River/Coulee City Rail Road
- Whitman Co. Transportation Policy Board
- Whitman Co. ISTEIA Selection Committee
- Port of Whitman County
- Palouse Economic Development Council
- Spokane Regional Transportation Council
- Palouse Planning Commission

For more information, please contact Keith Martin, Eastern Region WSDOT Local Programs Office, at (509) 324-6095 or by e-mail MartinK@wsdot.wa.gov. ▲



Words from the Chair

Summer is upon us and everyone has more work going on than they can possibly keep up with, or so it seems anyway. I know all the agencies are going to have a busy summer and will have many good stories to share at the fall conference.

We at the Ada County Highway District are applying GlassGrid to a section of asphalt as an experiment to see how well it will keep cracking from reflecting through. I will bring this information to the conference and share the findings on how the application went. Even though we're all very busy, I'd like to take this opportunity to encourage you to do some planning ahead for a couple of events that are coming up all too quickly.

The first event on the horizon that I wish to encourage your participation is the Pacific Northwest Transportation Technology Expo, which will be held again this year at the Grant County Fairgrounds in Moses Lake, Washington on September 11 - 12, 2002. This is a great event for all who attend, with "better mousetrap" displays and demonstrations by state and local agency personnel who developed the "mousetraps", equipment demonstrations, and vendor

"I wish to encourage your participation to make these events truly successful"

displays. After a busy construction season, this is truly a great way to unwind for a day or two and pick up some great ideas from your fellow workers.

The next event I want to encourage you to attend is the NWPMA Fall Conference to be held in Kennewick, Washington on October 1 - 4, 2002. This is a great time of year to visit the Tri-city area for great golfing weather. A very informative and educational conference agenda, that I think all will enjoy, is in the planning stages. Among the many topics to be presented are construction issues, ESA best management practices, pavement design, chip seal design, and many others I know you'll find interesting. Some special events are being considered for your enjoyment and there will

be the usual Pavement Manager of the Year award and elections of new NWPMA officers.

Please plan to attend; we need your participation to make these events truly successful. Stay safe and we'll see you in September and October.

George Alton,
Chairman NWPMA



Tips on Team Motivation

Following are edited suggestions on how to motivate your employees that were provided at the "Motivating your Team" workshop conducted as part of the Washington State Quality 2000 Conference.

Acknowledgement

- Saying, "thank you"
- Give praise
- Write a quick personal note
- A little chocolate and caffeine goes a long way
- Have a great celebration
- Appreciate publicly
- Recognize efforts immediately
- Give a free T-shirt
- Have a picnic
- Give consistent feedback
- Make appreciation personal and meaningful
- Post recognition letters on the bulletin board
- Give a recognition to others that you would like to receive yourself
- Celebrate anniversaries within the agency
- Provide acknowledgement in your newsletter
- Give a friendly "good morning"
- Give support and backing to your employees

Staff inclusion

- Develop, with your employees, a vision statement or theme that shows how your employees' work makes a difference. Publish the vision in your workplace.
- Have monthly "all-staff" meetings
- Share information
- Let employees see results
- Ask for employee input
- When you do meet with staff, be "present"
- Spend one-on-one time with employees
- Give employees time to share concerns and rejoice

Communicate

- Clarify expectations
- Give open, honest communication
- Listen
- Give employees your full attention
- Respond to questions promptly
- Work in teams

Find out what motivates your staff

- Match talents with jobs of the team
- Discuss their careers with them
- Be sincere about employees' well-being
- Make motivation personal
- Look for opportunities to establish rapport
- Walk around and get to know your employees
- Trust what employees tell you about their needs

Empowerment

- Let assistants manage something
- Provide independence
- Give employees tools to do their job and then give feedback
- Provide a flexible, positive, work environment
- Trust your employees
- Allow employees to build quality into their work
- Provide training

Trust

- Treat each employee fairly and equally
- Respect and trust

Fun

- Provide opportunities for laughter

Start with yourself

- You may need to get out of your comfort zone
- Show your own enthusiasm and motivation for being there.
- Love the work you do.
- Believe in yourself and know that you have a purpose.

New Users Guide Focuses on Creating Pedestrian Safety

*Reprinted from Transporter Research & Technology, March 2002, 2001
FHWA-RD-02-020*

In 2000, more than 4,739 pedestrians were killed and 78,000 were injured in U.S. motor vehicle crashes. These figures point toward a need to increase pedestrian and bicycle safety and mobility. Whether it's making improvements in crosswalks, sidewalks, walkways, and pedestrian technologies or expanding public education and safety programs, Federal Highway Administration's (FHWA) Pedestrian and Bicycle Safety Research Program strives to pave the way for a more walkable future.

A part of a larger FHWA study, Evaluation of Pedestrian Facilities, the Pedestrian and Bicycle Safety Research Program recently published the Pedestrian Facilities Users Guide-Providing Safety and Mobility to help transportation engineers, planners, and safety professionals make cities more pedestrian-friendly and safe. The Guide offers plenty of useful information about safe walking environments and highlights the main causes of pedestrian crashes and strategies for countering them.

Pedestrian Facilities Users Guide-Providing Safety and Mobility is also a tool for enabling professionals to identify pedestrian safety needs within roadway rights-of-way. It defines 13 pedestrian crash-type groupings and the types of possible safety countermeasures for each group in different crash situations. Along with this information, the guide also includes the



This photo shows pedestrians standing on a depressed median, four-lane separator. It might be safer under certain traffic conditions for the pedestrians to wait for the light to change on the corner of the road.



This intersection illustrates the use of several safe features including the "Walking Pedestrian" signal and a pedestrian crosswalk. Notice that several of the pedestrians crossing the street fail to remain within the "safe" crossing zone.

FHWA Software Package Estimates Work Zone Traffic Delays

purpose, considerations, and estimated costs for each countermeasure.

The Pedestrian Facilities Users Guide also supplies a number of case studies which highlight success stories in Asheville, NC; Cambridge, MA; Boulder, CO; Fort Pierce, FL; and Portland, OR; including traffic calming, reducing speed through neighborhoods, revitalizing downtown areas, and improving safety for children near schools.

A printed version is not yet available; however, the Pedestrian Facilities Users Guide is currently available online by visiting the following website:
http://safety.fhwa.dot.gov/fourth-level/design_p.htm#crosswalk. ▲

For further information, contact Ann Do at 202-493-3319 or ann.do@fhwa.dot.gov.

FHWA 6-02, www.dot.gov/affairs/briefing.htm

A new software package that the U. S. Department of Transportation's Federal Highway Administration (FHWA) helped develop can assist highway engineers in estimating traffic delays caused by work zones and the subsequent cost in time to drivers.

"Reducing delays in highway work zones is another way to improve mobility, which is one of the Department's strategic goals," said FHWA Administrator Mary Peters. "This program can give engineers a more accurate estimation of delays and queues and provide them with a planning tool that will help reduce the time motorists are delayed by work zone activity."

The software, called QuickZone, runs on a personal computer, furnishing the information in spreadsheet format. The system prompts the user as to just what data it needs to perform the necessary calculations. It can be used to compare the traffic impacts for work zone mitigation strategies and to estimate the costs to motorists in delays and potential backups associated with the different strategies or scenarios.

For example, QuickZone enables road owners and contractors to compare the effects of doing highway work at night instead of dur-

ing the day or diverting the traffic to one road versus another road at various stages of construction. These effects can be estimated for periods as short as one day or for the entire life of the construction project.

A survey released by the FHWA last year showed that improvements in traffic flow, pavement conditions, and work zones can result in the greatest rise in traveler satisfaction. The survey highlighted work zones as especially critical. Travelers view road repairs as a major contributor to traffic delays.

Four states (Maryland, North Carolina, Ohio and Wisconsin) are currently evaluating the software. Maryland is actually employing it on some of their work zone sites.

QuickZone can be ordered from either McTrans at the University of Florida (<http://www-mctrans.ce.ufl.edu>) or from PC Trans at the University of Kansas Transportation Center (www.kutrc.ku.edu/pctrans). The cost is \$195. ▲

For additional information please contact Ron Zeitz at (202) 366-0660

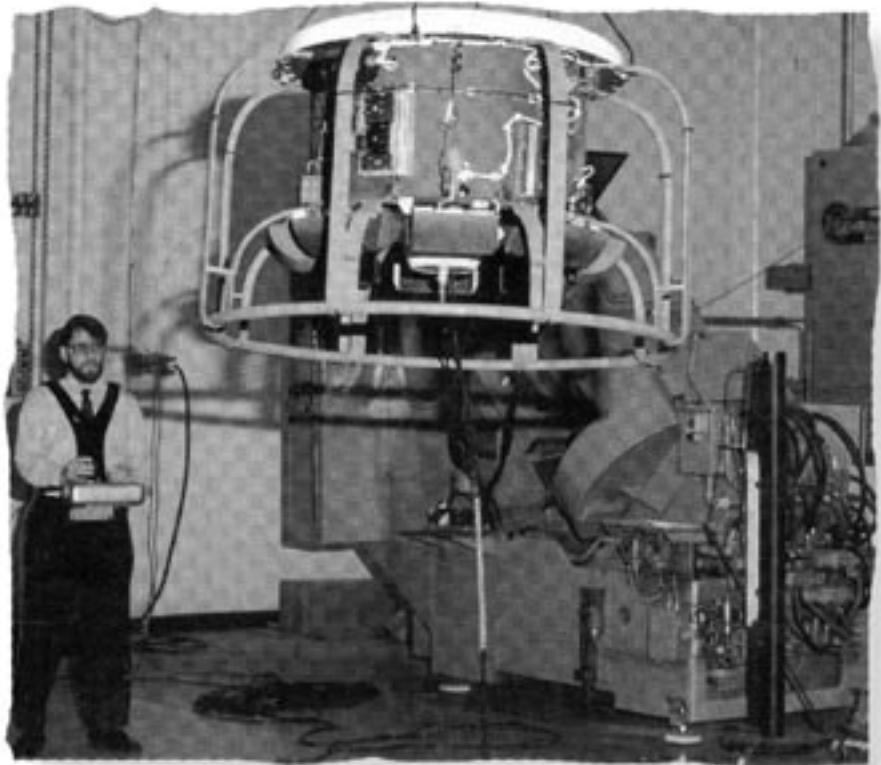
Next Generation of Inspectors Will Fly Under Tall Bridges

*Reprinted from Research &
Technology Transporter, April/May
2002*

Some bridge inspectors may possess hidden skills for accessing those hard-to-reach bridge girders, such as the talent to climb rocks or the ability to rappel from extremely tall heights. Because bridge structures can range from tens to hundreds of meters (or feet) in height, a one-man lift may not enable an inspector to reach those high areas for inspections and tests - making examinations lengthy, difficult, and unsafe for inspectors. The next generation of bridge inspectors will fly easily through these physical challenges.

As part of the Advanced Research team robotics program, the Federal Highway Administration (FHWA) is co-funding the Phase II pooled-fund development of the robot, Aerobot (for "aerial robot"), being led by California Department of Transportation (CALTRANS) and six other states. The Aerobot will perform bridge structure inspections, thereby reducing the risk to personnel and the completion time necessary to perform a physical inspection.

Already tested in prototype, the Aerobot is 0.6 meters (two feet) in diameter and able to vertically take off and land. It can be outfitted with cameras and other sensor packages, and can hover over and around large structures. In the electric version ordered by FHWA and CALTRANS, the Aerobot will carry a video camera and link to



the ground via a communications cable. This enables inspectors to remotely inspect the bridge, without the need to climb under or around the bridge's structure.

Aerobots use the ducted fan and stabilization and control technologies to supply vertical takeoffs, landings, hovering, and spatial positioning capabilities. Inspectors may operate the robots entirely autonomously as airborne robots, or semi-autonomously as remotely-controlled aerial platforms. The Aerobot performs vertical takeoff and landing functionalities from unimproved sites - without special launch or recovery equipment - and it hovers at a fixed point or moves

horizontally at moderate speeds. The ducted fan technology makes it safe and quiet, and a single operator can control the device.

The aerodynamics available on the Aerobot make it possible to fly the aerial robot up close to a structure for inspection without the risk of damage to either the structure or the robot. By enabling more frequent inspections of inaccessible and dangerous parts of superstructures, this system should improve the bridge maintenance scheduling; therefore helping meet the strategic goal of improving mobility. ▲

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Latest Highway Construction Specs on the Web

Reprinted from Research & Technology Transporter, April/May 2002

Specifications for highway construction and design are constantly in flux, which presents problems for engineers needing the latest information to build safe and cost-effective transportation system. With 50 State Departments of Transportation (DOTs) and other national transportation agencies constantly changing, updating and issuing new specifications on an as-needed basis, tracking specifications for new ideas, concepts, and processes becomes an implementation challenge.

The Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO), is launching a National Highway Specification website, providing state-of-the-art methods to electronically access and search specifications from National Transportation Agencies (NTAs), all State DOTs, AASHTO, the District of Columbia, the Territory of Puerto Rico, and many highway-related organizations. It will feature the most current and approved standard specifications and supplements; performance-related specifications (PRS); the latest quality assurance (QA) specifications; accessibility to other specification-related websites; and convenient links to the Natinla Highway Institute's (NHI) training materials. The group envisions the website as a clearinghouse and electronic library for searching,

reviewing, cross-referencing, and downloading the most up-to-date specification information.

FHWA and AASHTO plan three phases for website development. Phase I includes preliminary fact-finding research for designing the website, which will be used to develop a pilot website for testing. Special attention is being paid to creating a usable design, and an in-depth e-mail survey of 49 NTAs was conducted in 2000 with over 80 percent response rate. Go to www.fhwa.dot.gov/construction to visit the construction website.

In Phase 2, the team will incorporate approved materials from agencies across the country into the website. The project team will enhance the structure created in the pilot website development; will populate the site with content; and will add feature, as necessary. The team will complete the final website development from FHWA/AASHTO Technical Panel comments and a group of beta testers by late 2002. Phase 3 of the project incorporates the preparation of courses and NHI training programs. ▲

For more information, please contact Ken Jacoby, (202) 366-6503, ken.jacoby@fhwa.dot.gov.

Technology Infobit - The Internet

Courtesy of William C. Evans, LTAP Manager, USDOT-FHW

"San Francisco is the U.S. city with the highest Internet household penetration, at 66%, followed by Seattle with 64% and San Diego with 62%. Washington D.C. ranks fifth with 59%.

-U.S. Department of Commerce

"All high schools in Denmark have Internet access, and 95% of schools in Sweden. In contrast, only 23% of Italian schools are connected to the Internet"

-European Commission

"Each month Yahoo hosts a billion minutes of Internet phone calls, ships 6.1 billion messages and emails, and runs 15 million hours of audio and video"

-FORBES

"Original Ideas:

Internet 0

Humanity
1,000,000,000,000,000

-Peoplesoft.com

HSIS Develops New Online Safety Database Website

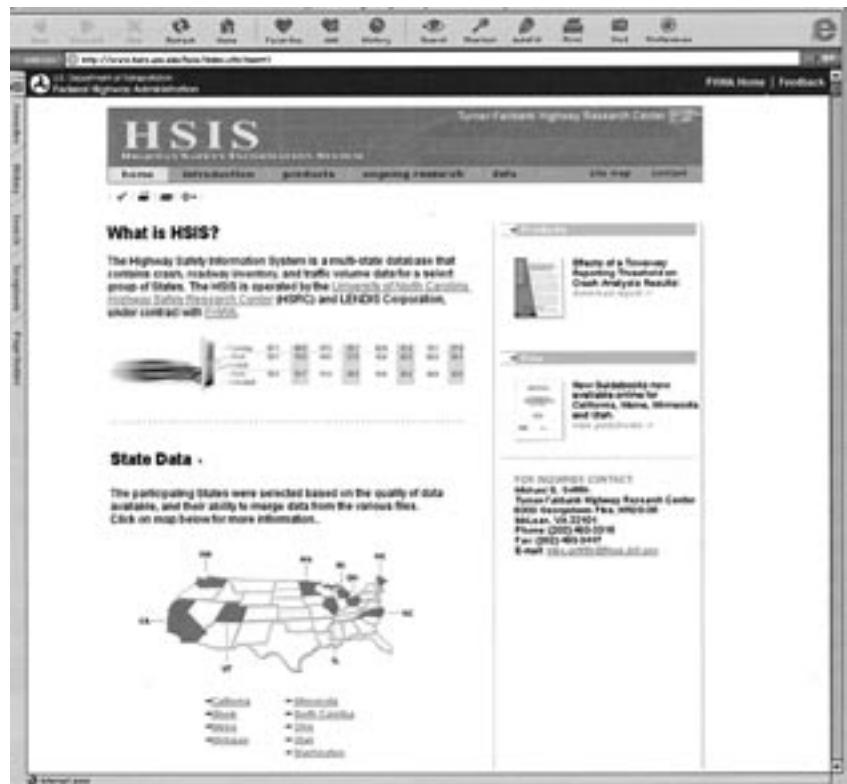
Reprinted from Research & Technology Transporter, April/May 2002

The design and operation of any highway system includes the potential safety impact on highway users. Making decisions about the appropriate system requires an understanding of geometric roadway design; roadside hardware selection and placement; traffic control measures; vehicle size and performance capabilities; and road users' needs and abilities — and how these factors impact safety and road development. By researching and analyzing crash information, roadway geometrics, traffic control devices, traffic volume data, and hardware/obstacle locations on the roadside, engineers can develop an understanding of how roadway and driver characteristics affect highway safety.

The Federal Highway Administration (FHWA) developed the Highway Safety Information System (HSIS), a highway safety database, which uses data already collected by states for managing their individual state highway systems. The HSIS is a roadway-based system providing quality data on a large number of accident, roadway, and traffic variables. Data are acquired annually from a select group of states, processed into a common computer format, documented, and prepared for analysis.

The HSIS can be used to analyze a large number of safety problems

ranging from the more basic “problem identification” issues, to identifying the size and extent of a safety problem, to modeling efforts that attempt to predict future accidents from roadway characteristics and traffic factors. Additionally, the HSIS supports the FHWA safety research program and provides input for program and policy decisions. It is available to analysts conducting research under the National Cooperative Highway Research Program, university researchers, and others involved in the study of highway safety.



More information about the HSIS can be found on the new HSIS website at www.tfhrc.gov. Visitors will find the following tools in the “Products” section of the website: summary reports, research reports, safety analysis tools, and published articles and technical papers in professional journals. The “Data” area contains state statistics, generic variable tables, guidebooks, and data request capabilities. ▲

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"Weeds Across Borders"

By Thanh Nguyen, BTEP Manager, WSDOT Maintenance Office

On May 1-3, 2002, the "Weeds Across Borders" conference was held in Tucson, Arizona. The purpose of the conference, sponsored and coordinated by the Federal Highway Administration (FHWA), was to bring together experts from the US, Canada, and Mexico to share information on the economic and environmental costs of invasive plants.

The conference provided a great opportunity to implement the Border Technology Exchange Program (BTEP), which is funded by FHWA. Doug Pierce, WSDOT Maintenance Environmental Manager, attended the conference to gain information and contacts that could be used to benefit the Department.

This conference provided speakers from many different arenas. They presented information on current conditions of the weed problem, shared common goals, and discussed possible ways of continuing continental cooperation. Several speakers discussed the need for practice and a rapid response sys-

tem for identifying and eradicating non-native plant species. A speaker from Canada suggested that the solution to weed control should include predictive models, monitoring, regulations, surveys, and information exchange. These solutions relate to the purpose of the BTEP, which is to spread as much new information as possible.

An informative report (conference handout) entitled "Meeting the Invasive Species Challenge," was provided by the National Invasive Species Council, 2001 and is available through the web at: www.invasivespecies.gov. This report articulates the economic and environmental costs of invasive species and details the framework for controlling and responding to the problem.

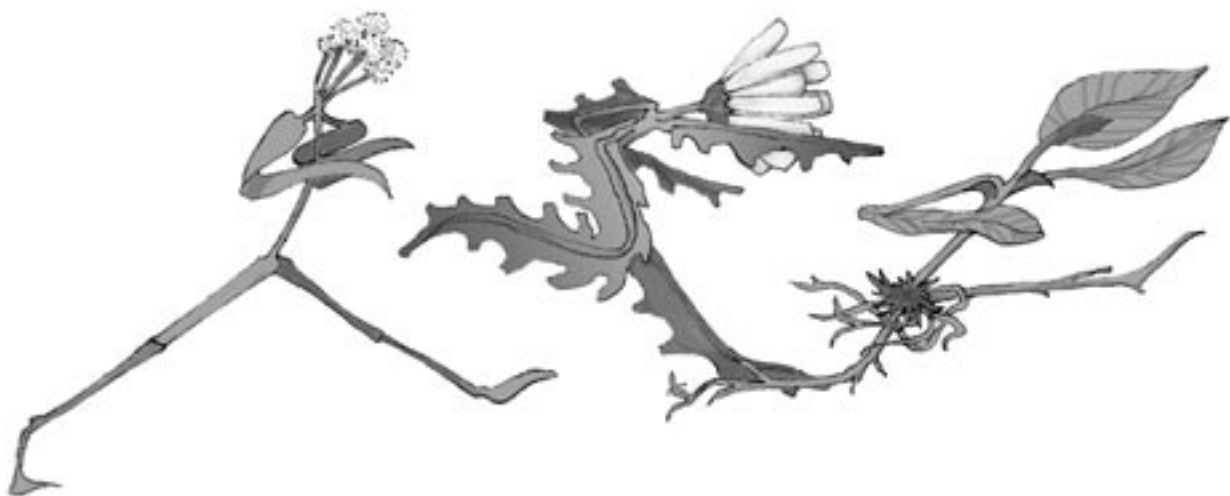
A disk entitled "Noxious & Nuisance Plant Management Information System (version 5)" was also distributed at the conference. This disk, which provides photos of noxious and nuisance weeds and specific management strategies for each weed, is available at no cost from the Army Corp of Engineers.

The overall reaction to the conference was very positive. The conference demonstrated the worth of bringing together experts from bordering states and Canada for sharing information.

The contacts that were made from the conference give the WSDOT Maintenance Office opportunities to present new speakers at the annual spring training events. This could be valuable and interesting information that could be shared with WSDOT vegetation management staff.

Future BTEP plans are to invite winter maintenance personnel from British Columbia to attend the Snow College that is being organized by the WSDOT Maintenance Office and a peer exchange between the WSDOT Maintenance Office, Oregon Department of Transportation, and the British Columbia Ministry of Transportation and Highways. ▲

If you would like additional information on this article or the BTEP please contact Thanh Nguyen at (360) 705-7814 or e-mail NguyeTh@wsdot.wa.gov.



Legislation and the Segway Human Transporter

Jennifer Boteler, WSDOT Librarian

One of the most publicized inventions of recent years, the Segway Human Transporter, was the subject of legislation in many state legislatures this past session. At least 21 states have passed legislation pertaining to the Segway, much of it addressing the regulatory authority of local agencies.

Dean Kamen, the inventor of the Segway, promises that the Segway will revolutionize transportation by curbing car use and relieving urban congestion. Proponents claim that the Segway will have more impact on society than the personal computer, the Internet, or the automobile.

The Segway is defined as an electric personal assistive mobility device (EPAMD). Powered by batteries and using a system of computer chip-driven gyroscopes and sensors, it mimics the movements of its rider. Standing on a small platform gripping a handlebar, the rider leans forward or backward to move in the desired direction. The device stops when the user stands straight. ("Lobbying Campaign Could Determine Fate of a Hyped Scooter" by David Armstrong, Wall Street Journal, March 1, 2002, Section A, Page 1, Column 1). The personal transport model of the Segway can travel at speeds of up to 14 mph and can go up to 17 miles on a single battery charge.

Although the Segway was launched in December 2001, it is not yet available to the public. The U.S. Postal Service, the Atlanta police force and General Electric Co. are testing the Segway. However, Kamen's company, DEKA Research & Development Corp., wanted to seek both federal and state regulatory approval before selling the device to the public. They needed to make sure that the Segway would not be regulated as a motorized vehicle and banned from sidewalks.

Their first step was to get the federal government to designate the device as a "consumer product," not a "motor vehicle." Last August the NHTSA likened the Segway to a motorized wheelchair and announced that the Segway wouldn't be subject to its motor vehicle regulations. Later that same month, the Consumer Product Safety Commission defined the Segway as a consumer product and indicated it would be regulated by the CPSC. Next, Segway lobbyists blanketed the country pushing for state laws that would permit Segways on sidewalks.

Consumer and safety advocates believe there are public safety concerns that still need to be addressed. For example, what are the impacts of a Segway colliding with a pedestrian or a bicyclist? Even if municipalities are allowed to regulate the speed at which Segways may be operated, how will this be enforced? Should Segway opera-

tors be required to wear protective gear, such as a helmet?

Washington is one of the states that passed legislation regulating electric personal assistive mobility devices (a.k.a. EPAMD and Segways). Engrossed Senate Bill 6316, Chapter 247, Laws of 2002, titled Electric Personal Assistive Mobility Devices, does the following:

- Excludes EPAMD from the definition of motor vehicle, motorcycle, motor-driven cycle, and vehicle.
- Provides that a driver's license is not required for operation of an EPAMD.
- Prohibits an EPAMD from highways, allows them on sidewalks, requires them to yield right-of-way to pedestrians.
- Municipalities and the Dept. of Transportation may prohibit the use of an EPAMD on public highways where the speed limit is greater than 25 mph.
- Municipalities may also restrict the speed of an EPAMD in areas with congested pedestrian or non-motorized traffic.
- State agencies or local governments may restrict the use of an EPAMD in areas used for recreation, open space, habitat, trails, or conservation purposes. ▲

For full text of the legislation and

WSDOT Library Your info link

for bill reports go to the Washington State Legislature, Bill Information web site at <http://www.leg.wa.gov/wsladm/bills.cfm> and enter "6316" in the Bill Number box.

Additional information on the Segway Human Transporter and on related legislative and public safety issues:

Segway LLC: <http://www.segway.com>

Segway News: <http://segway.weblogs.com/>

The Segway: How will it affect the pedestrian?: http://www.walkinginfo.org/insight/features_articles/segway.php

Columbia Children's Hospital, Center for Injury Research and Policy - Information on Legislation Regarding the Segway Human Transporter: <http://www.injurycenter.org/segway/segway.cfm>





*By Roger Chappell, WST2
Technology Integration Engineer,
WST2 Center*

GPS

"Beam Me Up, Scotty"

Over the last 10 years, Global Positioning System (GPS) has gone through quite a transition. From "black box" Star Trek type technology, to being installed in our cars, cell phones, and palm pilots. It has found its way into our hobbies, boating, hiking, biking, and hunting. As with the computer, new technologies hold promise of making our lives easier by doing complex tasks quickly and easily. Now with GPS, at the push of a button you can know where in the world you are, 24 hours a day, seven days a week in most any weather condition. Better yet, with SA (Selective Availability) turned off, you should be within approximately 15-meter circle or less. With GPS, knowledge of maps, charts, and compass can be achieved at the push of a button.

So what is the problem with that, you might ask? Nothing, I think it's great. My only caution is that technology is only as good as a person's ability to use it. In many cases it does provide a much better solution, faster and easier than older methods. But in the case of boating navigation for example, you could provide the best charts and compass in the world, and some people will still get lost. It

would be easy to point the finger and say that it was all the fault of the operator, when in fact it may have been "invisible forces" acting upon the boat that caused it to go off course. What I would like to cover in this article are some of those "invisible forces" that may effect how we navigate through this new technological environment.

Before we dive into those things affecting GPS (Global Positioning Systems), we need a brief understanding of what GPS is. In its simplest definition, GPS is a satellite based measuring system. GPS can be characterized as high tech measuring tapes floating in geosynchronous orbit at about 12,600 miles above the earth. If you could pull 12,600 miles of tape from four measuring tapes, the tapes should intersect at only one location near the surface. Instead of using actual measuring tapes, radio signals and time are used. Each SV (Space Vehicle) or satellite is equipped with an atomic clock and a radio transmitter. Since the radio waves travel at near the speed of light, if we know when the radio signal left the satellite, its precise location, and when it arrives at the GPS receiver, we can calculate how far it has traveled.

Luckily, the GPS receiver keeps track of all the radio waves, which SV's they originate from, how long it took them to reach their destination, the math required to compute distance, and finally, plots a location where they intersect. Once the receiver has determined where these radio waves intersect, it must translate that position into a coordinate system or datum that can be used by the operator. Since most maps and software use a coordinate system or datum to reference locations, it is really handy that a GPS receiver understands these systems and translates the radio waves and time modulations into something that can be used on a map.

Here are some terms that are used to describe this process. These terms are located in the glossary at: <http://www.mobilepositioning.com/glossary.asp>

C/A (Clear Acquisition) Code

This code is available to non-military users of GPS. It consists of a sequence of 1023 bits (0 or 1) that repeat every millisecond. Each

satellite broadcasts a unique 1023-bit sequence that allows a receiver to distinguish between various satellites. The C/A-Code modulates only the L1 carrier frequency on GPS satellites. The C/A-Code allows a receiver to quickly lock on to a satellite.

Pseudorange

Pseudorange is the measured distance between the GPS receiver antenna and the GPS satellite. The pseudorange is approximately the geometric range biased by the offset of the receiver clock from the satellite clock. The receiver actually measures a time difference which is related to distance range by the speed of propagation.

PRN Number (Pseudo Random Noise)

PRN number is the identity of the GPS satellites as determined by a GPS receiver. Since all GPS satellites must transmit on the same frequency, L1 and/or L2, they are identified by their own pseudorandom noise codes.

Universal Time Coordinated (UTC)

UTC is time as maintained by the U.S. Naval Observatory. Because of variations in the Earth's rotation, UTC is sometimes adjusted by an integer second. The accumulation of these adjustments compared to GPS time, which runs continuously, has resulted in an 11 second offset between GPS time and UTC at the start of 1996. After accounting for leap seconds and using adjustments contained in the navigation message, GPS time can be related to UTC within 20 nanoseconds or better.

Now that we have an idea of how GPS works, let's get back to the things that can cause positional errors, the "invisible forces" in our technological environment.

Time is a very critical element since GPS signals are traveling at speeds near the speed of light (approximately 186,000 miles per second). Even small obstructions like the signal passing through the window of a car can slow it down enough to cause positional errors. Basically you want line-of-sight between your GPS receiver and the satellites. If you are using GPS while hiking in an area with heavy tree canopy, you should be able to find a place to get good enough readings to get you back to your car. If you are collecting data under tree canopy, you may need to incorporate some mission planning and other procedures that will help to achieve the quality of data that you need.

Mission planning typically involves using software that tracks the satellites' orbits over time. It will help you to predict when the satellites will be in the best position at a given location to collect your data. If you are doing a lot of work around tree canopy, there are some good resources on the web. The US Forest Service has a report called "Comparison of GPS Receivers Under a Forest Canopy with Selective Availability Off" that can be downloaded from the web at: http://www.fs.fed.us/database/gps/mtdc/gps2000/gps_comparison.htm

Sometimes when working under tree canopy, you may have to wait until the fall (when the leaves fall from the trees) or use a laser range finder to collect your data. With a laser range finder you are able to stand with your GPS receiver in an open area and get a bearing, distance, and range to an object under obstruction. Some receivers integrate this feature into their data collection package.

Other invisible forces may be satellite obscuration, atmospheric conditions, and poor geometry. To achieve a two dimensional position (X & Y), you need a minimum of three satellites. To achieve a

three dimensional position (X, Y, & Z with Z being height), you need a minimum of four satellites. You may have more than the required number of satellites, but you need to have good signals from the minimum number of them to compute a good location. Many receivers today allow you to mask out signals that don't meet your predefined requirements.

Obscuration

This term is used to describe the periods of time a GPS receiver's line-of-sight to GPS satellites is blocked by natural or man-made objects. Your mission planning exercises may have told you when the most satellites will be available, but when you get to the site you find a large building or hill blocking some of your satellites. Most mission planning software will allow you to mask out the obstruction and recompute a new time for data location. In some urban and physical canyons it may take some serious planning to be able to get good satellite geometry.

Sometimes the GPS signals are slowed down by what is known as multipath. This is when a signal reflects off wet leaves, a window, truck, or some other object. If you are on a hike, multipath shouldn't give you any problems. However, if you are out collecting data, you'll want to understand what causes multipath and how to minimize its effects. A little reflection off an object at the speed of light may slow a signal significantly. You will need to look at your receivers masking capabilities to filter out unwanted multipath signals. Another one to watch for is the SNR (signal to noise ratio). How "dirty" of signals will you allow in your mix? The trick to masking is finding the balance, too much masking and you may get very high accuracy, but you may only be able to work in the middle of the ocean with no trees or other interference.

Before we end with satellite geometry, I want to throw in elevation masking. An elevation mask is an adjustable feature of GPS receivers that specifies that a satellite must be at least a specified number of degrees above the horizon before the signals from the satellite are to be used. Satellites at low elevation angles (five degrees or less) have lower signal strengths and are more prone to loss of lock thus causing noisy solutions. The signals from satellites that are low on the horizon also have to travel through noisier atmosphere than satellites that are overhead.

The last area that I will cover in this article is the mysterious DOP or dilution of precision. As you look through the following definitions, you'll quickly notice one common thread; the lower the value, the greater the confidence in the solution. Some receivers will allow you to mask out poor geometric solutions. How much you need to know about DOP depends on your application. If you find that some "invisible forces" are mysteriously throwing your data off, PDOP, or position dilution of precision, would be the first DOP mask to check into. Since people always seem to bring up other members of the DOP family, I have included a brief definition for them as well. There are many good resources on the Web. I chose the following resources because they were handy.

■ **Mobile Positioning at**
(<http://www.mobilepositioning.com/glossary.asp>) defines DOP as a value expressing the confidence factor of the position solution based on current satellite geometry. The lower the value, the greater the confidence in the solution.

■ **Red Sword Corporation at**
(http://redsword.com/gps/old/sum_def.htm) defines DOP as a function expressing the mathematical quality of solutions based on the geometry of the

satellites. PDOP, the most common such value, has a best-case value of 1, higher numbers being worse. The best PDOP would occur with one satellite directly overhead and three others evenly spaced about the horizon. Higher numbers of PDOP are worse. PDOP could theoretically be infinite, if all the satellites were in the same plane. PDOP has a multiplicative effect on the user range error (URE) value. A URE of 32 meters with a PDOP of one would give a user an assumed best accuracy of 32 meters. A PDOP of 2 would result in an assumed accuracy of 64 meters. Many receivers can be programmed to stop providing position solutions above a specific PDOP level (6 is common).

■ **GPS Support Center**
(http://www.spacecom.af.mil/USSPACE/gps_support/archive/Frontpage/J053DOPsPike.htm)
DOP is when GPS ranging accuracy is diluted by the geometry of the constellation. All receivers use some form of DOP calculation to determine which of the satellites in view are the best ones to track. There are many different forms of DOP calculation, but the most frequently used is PDOP. PDOP factors in elements of both Horizontal DOP and Vertical DOP. Though the 2nd Space Operations Squadron (2 SOPS) works to optimize the constellation's geometry, a transitory area of degraded PDOP will occasionally form somewhere on the earth's surface. This area of degraded geometry is often referred to as a PDOP 'spike'.
<http://www.forestry.umn.edu/academics/courses/X495/planning.htm>

■ PDOP is likely going to be one of your most important data collection constraints. As the PDOP value increases, both the horizontal and vertical precision of your data points decreases.

■ **PDOP - Position Dilution of Precision**
A numerical value expressing the confidence factor of the position solution based on current satellite geometry. 3D position (latitude, longitude, height) is unknown. The lower the PDOP value, the greater the confidence factor.

■ **GDOP - Geometric Dilution of Precision**
All parameters (latitude, longitude, height, clock offset) A measure of the confidence factor of the position solution based on current satellite geometry. GDOP assumes that the 3D position (latitude, longitude, height) and receiver clock offset or time are variables in the solution. The lower the GDOP value, the greater the confidence in the solution.

■ **Mask Angle**
The minimum GPS satellite elevation angle permitted by a particular GPS receiver design. Satellites below this angle will not be used in position solution. This solution can reduce satellite visibility, but sometimes improve GDOP.

■ **HTDOP_ - 2D parameters and (latitude, longitude, time) - Horizontal position and Time Dilution of Precision**
A numerical value expressing the confidence factor of the position solution based on current satellite geometry and assumes the altitude is known. The lower the HTDOP value, the greater the confidence factor.

■ **HDOP_ - 2D parameters (latitude, longitude) - Horizontal Dilution of Precision**

A numerical value expressing the confidence factor of the horizontal position solution based on current satellite geometry. No constraining assumptions regarding time and altitude are

considered here. The lower the HDOP value, the greater the confidence in the solution.

■ **VDOP_ - height - Vertical Dilution of Precision**

A numerical value expressing the confidence factor of the position solution based on current satellite geometry. The lower the VDOP value, the greater the confidence factor.

■ **TDOP_ - clock offset - Time Dilution of Precision**

A numerical value expressing the confidence factor of the position solution based on current satellite geometry. The lower the TDOP value, the greater the confidence factor.

Can you locate a position and return to that same position consistently, within some known circle of accuracy? That is the true test of any measurement system. GPS has proven that itself as an excellent system for repeatable measurements. It is faster and easier to use than most traditional methods, but it is one tool in the toolbox, and it won't replace the toolbox it's self. The better you know how to wield it, the better your end result should be. ▲

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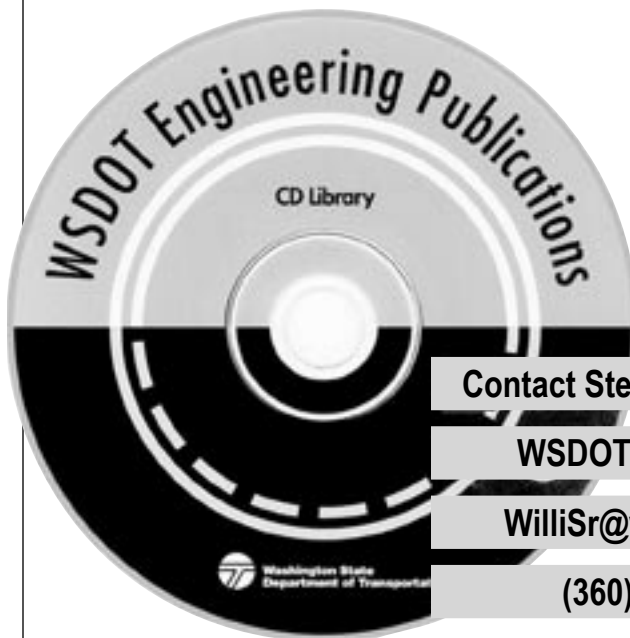
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- Asset Management Primer, FHWA, 1999
- A Walkable Community is More Than Just Sidewalks, FHWA, 2000
- Bicycle & Pedestrian Case Studies: No. 7: Transportation Potential & Other Benefits of Off-Road Bicycle & Pedestrian Facilities, FHWA, 1992 No. 14: Benefits of Bicycling and Walking to Health, FHWA, 1993 No. 15: Environmental Benefits of Bicycling & Walking, FHWA, 1993
- Concrete Pavement Repair Manuals of Practice, SHRP, 1993
- Concrete PASER Manual, University of Wisconsin, 1998
- Contracting for Professional Services in Washington State, MRSC, 1994
- Crack Seal Application, FHWA, 2001
- Data Integration Primer, FHWA, 2001
- Dust Control on Low Volume Roads, FHWA, 2001
- Dust Palliative Selection and Application Guide, USFS, 1992*
- Engineer's Pothole Repair Guide, US Army Corps of Engineers, CRREL, 1984
- Family Emergency Preparedness Plan, American Red Cross, et al., 1998
- Field Guide for Unpaved Rural Roads, Wyoming T2 Center, 1997
- Fish Passage Through Culverts, FHWA, USDA, 1998
- General Field Reference Guide (Pocket Size), 2002
- Geotextile Selection and Installation Manual for Rural Unpaved Roads, FHWA - 1989
- Getting People Walking: Municipal Strategies to Increase Pedestrian Travel, Rhys Roth, Energy Outreach Center
- Gravel Roads – Maintenance and Design Manual, SD LTAP, 2000*
- A Guide to the Federal-Aid Highway Emergency Relief Program, USDOT, June 1995
- Local Agency Pavement Management Application Guide, WST2 Center, 1997*
- A Guide for Local Agency Pavement Managers, NWT2 Center, 1994*
- A Guide for Erecting Mailboxes on Highways, AASHTO, 1984
- Highway / Utility Guide, FHWA 1993
- Improving Conditions for Bicycling and Walking, FHWA, 1998
- Improving Highway Safety at Bridges on Local Roads and Streets, FHWA, 1998
- International State-of-the-Art Colloquium on Low-Temperature Asphalt Pavement Cracking, CRREL, 1991

- Washington Bicycle Map, WSDOT, 2001
- Wetland Trail Design and Construction, USDA, 2001

Workbooks and Handouts from WST2 Center Workshops:

- Application of Geographic Information Systems for Transportation, FHWA, 1999
- Construction Documentation: Construction Training Manual for Local Agencies, WSDOT, 2002
- Design, Construction and Maintenance of Highway Safety Features and Appurtenances, FHWA, 1997 (update included)
- Handbook for Walkable Communities, by Dan Burden and Michael Wallwork
- Highway Maintenance Welding Techniques and Applications, Tom Cook, Cornell Local Roads Program, 1995
- Pavement Maintenance Effectiveness/ Innovative Materials Workshop Participant's Handbook
- Snow & Ice Control Chemicals, Theory & Practice, Dale G. Keep, Ice & Snow Technologies, LLC,

Videotapes:

Walkable Communities: Designing for Pedestrians, Dan Burden, \$50/set of 4 videotapes

CD ROM:

- Gravel Roads: Maintenance and Design Manual, SD LTAP, 2000*
- Intelligent Transportation Systems Awareness, FHWA, 1999
- Pedestrian/Bicycle Crash Analysis Tool, FHWA, 1999
- Pedestrian/Bicycle Safety Resource Set, FHWA, 2000
- Pavement Preservation: State of the Practice, FHWA, July 2000
- Rockfall Catchment Area Design Guide, ODOT, 2002*
- Technology Transfer CD Library Technical Documents, 2002

*Denotes publications included in 2002 WST2 Technology Transfer CD Library: Technical Documents

Non-Credit Self-Study Guides:

These non-credit WSDOT self-study guides may be obtained from the WST2 Center. An invoice will be sent with the books.

- Basic Surveying, \$20
- Advanced Surveying (metric), \$20
- Contract Plans Reading, \$25
- Technical Mathematics I, \$20
- Technical Mathematics II, \$20
- Basic Metric System, \$20

H&LP Online Publications & Information:

City Streets as part of State Highways
\\trout\www\wsdot\TA\Operations\LAG\CityStreets.html

Environmental Procedures Manual (M31-11) <http://www.wsdot.wa.gov/eesc/environmental/programs/regcomp/ProceduresManual/start.pdf>

Local Agency Guidelines and Updates
<http://www.wsdot.wa.gov/TA/Operations/LAG/LAGHP.htm>

Federal Aid Progress Billing Form <http://www.wsdot.wa.gov/TA/ProgMgt/Projectinfo/BILLFORM.XLS>

State Funded Progress Billing Form <http://www.wsdot.wa.gov/TA/ProgMgt/Projectinfo/BILLFORMSTATE.xls>

STIP (State Transportation Improvement Program) <http://www.wsdot.wa.gov/TA/ProgMgt/STIP/STIPHP.htm>

TIP (Local Agency 6-Year Transportation Improvement Program) <http://www.wsdot.wa.gov/TA/ProgMgt/STIP/TIP.html>

Bicycles/ maps, guidelines, trails, research <http://www.wsdot.wa.gov/TA/PAandI/PAIHP.html>

Pedestrians/ project funding sources, research, trails <http://www.wsdot.wa.gov/TA/PAandI/PAIHP.html>

Heritage Corridors/ grants, Scenic Byways, funding sources <http://www.wsdot.wa.gov/TA/PAandI/PAIHP.html>

Pavement Publications & NWPMA links <http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/PavementTechnology/>

Links to Training and Other Valuable Resources

Get on our e-mail communication "List-serve" <http://www.wsdot.wa.gov/TA/T2Center/T2HP.htm>

Safety Management Publications & Information <http://www.wsdot.wa.gov/TA/T2Center/Mgt.Systems/SafetyTechnology/>

Register Online for WST2 Classes & Other Information <http://www.wsdot.wa.gov/TA/T2Center/T2HP.htm>

Have you Built a "Better Mousetrap?" Local Agency folks in Washington state are invited to bring their inventions to the Pacific Northwest Transportation Technology Expo in Moses Lake, Washington, Sept. 11 & 12, 2002. <http://www.wsdot.wa.gov/ta/T2Center/TechnoExpo/MouseTraps.html>

Retired Professional Program <http://www.wsdot.wa.gov/TA/T2Center/Retired.htm>

Student Referral Program-Engineering students are hired by local agency public works departments for "Hands-on" summer experience <http://www.wsdot.wa.gov/TA/T2Center/SRS.htm>

Computer Programs

The following computer program may be downloaded from the Internet at: www.wsdot.wa.gov/fossc/mats/Apps/EPG.htm:

Everseries Pavement Analysis Programs: This series of programs contains three independent modules:

1. Evercalc 5.0 – A FWD Pavement Moduli Backcalculation Program
2. Everstress 5.0 – A Layered Elastic Analysis Program
3. Everpave 5.0 – A Flexible Pavement Overlay Design Program

Important: These programs are updated regularly. Please send your e-mail address to sivanen@wsdot.wa.gov to be included in the mailing list for updates.

FWD Area Program - This program is useful in calculating Normalized Deflections Area Value, and Subgrade Moduli from FWD Data. The program is available for download at www.wsdot.wa.gov/fossc/mats/pavement/fwd.htm



Laurel Gray, WST2
Training Program
Coordinator

Washington State T2 Center

Contact: Laurel Gray (360) 705-7355
Wendy Schmidt (360) 705-7386
<http://www.wsdot.wa.gov/TA/T2Center/train2.htm>

*To register for a class in this section, use the contact listed above.
The class fees shown apply to both public and private sector students.*

Snow and Ice Control Chemicals: Theory and Practice

September 17, Pasco, September 18, Colville, October 2, Okanogan, October 3 (by special request), October 9, Bellingham, October 10, Port Angeles. **\$35.** If you would like to host the October 3rd session in your agency, call Laurel Gray. Sessions will cover the difference between anti-icing and deicing, when each is appropriate for use, and how to use each method correctly. Included will be information on the advantages and disadvantages of both liquid and solid deicers, how they work, why they work and their limits, and a session on Total Storm Management.

CORSIM Traffic Simulation Model

September 17-19, Lacey. **\$290.** This class provides an understanding of CORSIM - a tool that simulates traffic and traffic control conditions on combined surface street and freeway networks. CORSIM determines how traffic engineering and control strategies impact a prescribed network's operational performance, as expressed in terms of various Measures of Effectiveness (MOEs). The MOEs (such as speed, travel, time, volume, delay) provide insights into the effects of the applied strategy on traffic operations and provide the basis for optimizing the applied strategy. CORSIM, the simulation package within the Traffic Software Integrated System (TSIS) suite of tools, is a powerful

tool that can be applied to wide areas of interest. This is a WSDOT sponsored class and limited space has been made available for local agencies. Early registration is advised.

Pavement Condition Rating Workshop*

September 24-25, Tacoma. **\$45.** Participants will learn to rate any of the pavements commonly found in Washington. The rating values obtained using the definitions and methods learned in this course should compare favorably with those obtained and used in the Washington State Pavement Management System. At the conclusion of the class each participant should be able to perform a pavement condition survey with reasonable objectivity.

PS&E Contract Preparation

September 24-25, Vancouver; October 15-16, Bellevue; November 12-13, Tacoma. **\$75.** This two-day class covers the preparation of PS&E by WSDOT, consultants, and local agency staff. Instruction will be based on the Plans Preparation Manual as well as other references. The course includes contract special provision writing. It will cover the most recent requirements for preparing complete, biddable, constructible, and defensible plans, and the most recent requirements for writing complete, concise, and well-formatted special provisions.

Basic Supervisory Skills*

October 1, NWPMA Conference, Kennewick. 9:00 am – 4:00 pm. **Free.** This workshop, held at the Northwest Pavement Management Association Fall Conference, will help new and established managers to hone their supervisory skills. The workshop, presented by David Grouchy, Director of the Louisiana T2 Center, will provide managers with useful skills and information on the role and responsibility of the supervisor and effective personnel management and conflict resolution tools. If you plan to attend the workshop and conference please check the appropriate box on your registration form; however you do not have to be registered at the conference to attend. Registration is through the NWPMA, or for non-conference attendees, call the T2 Center or register on-line.

Introduction to GPS Mapping Grade Equipment

October 8-10. Class is held at WSDOT's Olympic Region training room in Tumwater, or in individual agency. **\$325.** This training is an introductory course on mapping grade GPS equipment. It is designed to provide basic knowledge and skills in the use of Global Positioning System technology in mission planning, data gathering, and data processing. The training will enable field operation personnel to use new methods

and Trimble mapping grade equipment as well as understand problems encountered when using the GPS satellite constellation. For planners, technicians, engineers, and designers who will collect GPS data for mapping, use GPS data as an end product, supervise or manage data collection, or who need to use GPS to locate roadway features. Classroom and field exercises.

Highway Program Financing

October 9-10, Wenatchee; November 19-20, Seattle/Tacoma area (November date is tentative) **\$240**. This National Highway Institute course covers the various aspects of Federal-aid highway financing unique to the FHWA program. Topics include: The content and policy implication of authorizing and appropriating legislation; the way Federal-aid highway funds are distributed to the states including discussion of contract authority, apportionment and allocation, deductions, earmarking, transferability, and obligation; the effect of policy and budget considerations on the use of Federal-aid funds, especially as manifested through obligation limitations; and the operation of the Highway Trust Fund and its significance to the funding level for the Federal-Aid Highway Program.

Advanced Biological Assessment Preparation*

October 24, Lacey. **\$35**. Instructor: Marion Carey. Topics include biological assessment content, information analysis, making appropriate effect determinations and common problems found in biological assessments. It will also cover conducting Essential Fish Habitat consultations. Students will come away with an understanding of how to complete the contents of the biological assessment such as how to define the action area, and how to make and document effect determinations. Prerequisite: Introduction to ESA and Biological Assessments, or an understanding of the ESA and some experience writing biological assessments.

Anatomy of a Grant: Grantwriting

October 29-30, Yakima; December 17-18, Tacoma. **\$150**. Instructor: Sharon Bridwell. In this two-day workshop you will learn some practical steps to take toward grantwriting and how to approach the right funders for the dollars you need. The class will discuss writing three types of grants: federal, state, and foundation. Students have rated this as the best grantwriting class they have ever taken and find the information immediately useful.

Bridge Condition Inspection Fundamentals

November 12-14, Vancouver. **Free to Washington State local agencies, \$150 to out of state**. This is a special session of the BCIF and is intended for maintenance personnel as opposed to engineering and design technicians. Bridge classes are generally scheduled in February and March every year. This training session is intended to provide maintenance personnel, who have little or no background in bridges, a basic knowledge of bridges and bridge maintenance and inspection skills.

Construction Documentation

December 4, Vancouver; December 11, Olympia; January 14, North Seattle; January 15, South Seattle; February 11, Olympic Peninsula; February 12, Tacoma; March 11, Spokane; March 12, Moses Lake; March 13, Yakima; April 8, North Seattle; April 9, South Seattle. **Free**. For registration in Northwest Region, contact Dave Engle at (206) 440-4733, all others register through the WST2 office or on-line.

Classes scheduled for 2003

Bridge Condition Inspection Fundamentals

February 11-13, Lacey. **Free to Washington State local agencies, \$150 to out of state**.

Bridge Condition Inspection Update

February 4-5, Lacey; February 19-20, Ellensburg. **Free**.

Bridge Condition Inspection Training

March 3-7 and March 10-14, Lacey. Two weeks of training. **Free to Washington State local agencies, \$150 to out of state**.

Basics of a Good Gravel Road

Four session in April. **\$35**

Anatomy of a Grant: Grantwriting

Four or five sessions in June and July. Tentatively Moses Lake, Port Orchard, Tacoma, Goldendale, Bellingham. **\$150**

LAG Training

- Construction Documentation – LAG Manual Chapters 51, 52, and 53. 2002-2003 schedule is listed in T2 section, eleven sessions to be held beginning in December and running through April 2003. Classes are free.
- Consultants – LAG Manual Chapter 31.
- Disadvantaged Business Enterprise (DBE)/EEO/OJT – LAG Manual Chapters 26 and 27.
- Design Standards from PS&E to Award – LAG Manual Chapters 42-46. T2 offers many PS&E training sessions every year. See scheduled classes in T2 section. Cost is \$75.
- Emergency Relief Program – LAG Manual Chapter 33. Training in October/November 2002.
- Enhancement Program – LAG Manual Chapter 62. About a year away from training, waiting on a new Federal act.
- Environmental/Introduction – LAG Manual Chapter 24. This includes Section 106 Process. Classes to be developed based on interest.
- Funding Workshop – LAG Manual Chapters 12, 21, 22, and 23. Agreements and supplements, prospectus, progress billings. Classes already held. More will be scheduled based on interest.
- Right of Way Procedures – LAG Manual Chapter 25 and the Federal Perspective. Some classes have already been held. More will be scheduled this year based on interest.
- LAG Manual Overview – Classes already held. More will be scheduled based on interest.

Please use the on-line link below to register your interest in a course. When there are enough people interested in a particular course, a session will be scheduled and you will be notified.

<http://www.wsdot.wa.gov/TA/Operations/LAG/Lagtrain.HTM>

If you have any questions about the LAG Program, call Ron Pate at (360) 705-7383 or e-mail paterd@wsdot.wa.gov.

The Endangered Species Act 4(d) Training Program

The Regional Road Maintenance ESA training is underway and the pilot phase of the training is nearly complete. This phase is considered crucial to assuring a consistent presentation of the training goal, namely, explain the ESA objectives, describe the Regional Road Maintenance Program, and finally, utilize team concepts in hands-on applications of BMP's to solve real roadway maintenance work. The University of Washington's Transportation Professional Development Program (TRANSPEED) is coordinating and presenting

the training program.

Classes have been scheduled and agencies that have committed to the Regional Road Maintenance Program (RRMP) Guidelines by submitting a "Part 3 Application" will be given priority for spots in the classes.

Tuition costs have now been determined for all tracks and are shown below. The current series of training tracks are described below including tuition rates. For program information or course registration, please contact Julie Smith at (206) 543-5539 or by email: jsmith@enr.washington.edu.

The Part 3 Application, which is a commitment to ten program elements (of which the training program is Element #4), can be obtained from the following web site: <http://www.metrokc.gov/roadcon/bmp/pdfguide.htm> or by contacting Janine Johanson at METRO KC (206) 205-7101.

Four ESA Training Tracks

The complete ESA Training Plan has been grouped into four separate tracks: (1) Briefing for regional level decision makers, (2) a training course addressing maintenance design and technical staff procedures involved in roadway maintenance activities, (3) a training course addressing field crew practices involved in roadway maintenance activities, and (4) courses to train agency level trainers in training skills applicable to the ESA training program. These trainers are selected by their agencies for this training. Track 4, the trainer training tracks, is divided into two areas: Track 4A will teach individuals instruction skills to teach the engineer and technical staff portion of the program and Track 4B will teach individuals instructional skills to teach the field crew portion.

- Track 1: Briefing for Regional Decision Makers 2 hours. No fee. An overview of the ESA program for regional level management and administration. This is a stand-alone training class and not part of the required training program. Offered by members of the Regional Road Maintenance Forum. Call Roy Harris or Gerry Crum at (425) 257-8800 for information. Information may also be obtained from the web site or by calling Janine Johanson at METRO KC (206) 205-7101.
- Track 2: Introduction, Design and BMP's, Monitoring, and Environmental Roles for Technical and Scientific Staff 2 days. \$225 per person. This course is a combination of the various procedures for technical, professional and environmental staff, supervisors and leads involved in maintenance activities. The tack is an overview addressing: introduction to the Guidelines, design, habitat, ten program elements and maintenance BMP's to meet ESA requirements.
- Track 3: Introduction and Outcome-based Road Maintenance 1 day. \$160 per person. This course is a combination of the various procedures for field crews

and leads involved in maintenance activities. The tack is an overview addressing: introduction to the Guidelines, design, habitat, environmental roles, ten program elements and implementation of maintenance BMP's to meet ESA requirements.

- Track 4A: Train-the Trainer for Technical/Scientific Staff 1 day. \$210 per person. For agency-selected ESA trainers. This is the training track to train, evaluate, prepare, and certify candidates to teach the RRMP Track 2.
- Track 4B: Train-the-Trainer for Field Crews and Supervisors 1 day. \$230. For agency-selected ESA trainers. This the training track to train, evaluate, prepare, and certify candidates to teach the RRMP Track 3.

TRANSPEED **University of Washington**

Contact: Christy Roop
(206) 543-5539, fax (206) 543-2352
<http://www.engr.washington.edu/epp>

*To register for a class in this section, use the contact listed above.
The prices in this section are for local agency/non-local agency.*

Managing Scope, Schedule and Budget

August 26-28, Seattle; October 30-November 1, Lacey.
\$660/\$860

Traffic Calming: Techniques and Management

September 18-20, Seattle. \$295/\$495

Bridge Foundation Design

September 24-26, Lacey. \$265/\$465

Legal Liability for Transportation Professionals

October 1-2, Seattle. \$245/\$425

Fundamentals of Traffic Engineering

October 9-11, Seattle. \$325/\$525

Hydrology and Basic Hydraulics

October 16-17, Lacey. \$245/\$425

Access Management

October 30-November 1, Seattle. \$295/\$495

Construction Inspection of Public Works Projects

November 4-5, Seattle. \$245/\$425

Public Works Construction Project Management

November 7-8, Seattle. \$345/\$525

Roadway Culvert Hydraulic Design

November 13-14, Lacey. \$245/\$425

Introduction to Retaining Wall Type Selection and Layout

November 14, Seattle. \$175/\$300

Manual on Uniform Traffic Control Devices (MUTCD)

November 18-20, Seattle. \$295/\$495

Techniques for Pavement Rehabilitation

November 19-21, Lacey. \$295/\$495

Pavement Design

December 3-5, Seattle. \$295/\$495

Basic Highway Capacity 2000

January 6-8, 2003, Lacey. \$295/\$495

Engineering Professional Programs (EPP) University of Washington

Contact: Emily West
(206) 543-5539, fax (206) 543-2352
<http://www.engr.washington.edu/epp>

To register for a class in this category use the contact listed above.

Engineering Refresher Courses

Three courses offer engineers intensive preparation for the state of Washington qualifying examinations. Evening course sessions will be held on the campus of the University of Washington in Seattle. Experienced instructional teams of UW faculty and industry professionals present a review of topics relevant to each examination. Course sessions focus on background theory and selectively emphasize problem solving and solution methods.

Fundamentals of Engineering/E.I.T. Exam Review Course

September 4 – October 14, 2002. **\$495.** Monday & Wednesday, 6:30 - 9:00 PM

Mechanical PE Exam Review Course

September 10 – October 17, 2002. **\$645.** Tuesday & Thursday, 6:30 - 9:00 PM

Civil PE Exam Review Course

September 12 – October 17, 2002. **\$495.** Tuesday & Thursday, 7:00 - 9:30 PM

Fleet and Shop Management Workshops

One workshop: **\$345**
Both workshops: **\$640**

Two interactive workshops for fleet professionals taught by John Dolce, respected fleet manager, consultant and educator. Develop cost-effective management strategies suited to your operation. Practice what you've learned in group activities that utilize planning, organization, implementation and evaluation. Workshops include extensive course materials, breakfast and a certificate awarding CEUs from the University of Washington.

Analytical Fleet Management

Friday, October 25 8 a.m. – 5 p.m.

Effective Shop Management

Saturday, October 26 8 a.m. – 5 p.m.

Drilling and Blasting Techniques for Construction and Quarrying in Seattle

January 12-16, 2003. 8 a.m. – 5 p.m. **\$1,199 by Dec 30/\$1,299 thereafter.** Learn to effectively plan and manage the drilling and blasting project from initial cost estimation to final project evaluation. Special emphasis will be placed on the role project management plays reducing risk and legal liability.

Professional Engineering Practice Liaison (PEPL) University of Washington

Contact Stephanie Strom
(206) 543-5539, fax (206) 543-2352
<http://www.engr.washington.edu/epp>

To register for a class in this category use the contact listed above.

Wetland Ecology and Land Use Implications

September 18 and 19, UW Bothell Branch Campus. **\$475 by September 4, \$510 thereafter.** Optional field trip: Friday, September 20, 2002. **\$95 by September 6, \$115 thereafter.**

Fundamentals of Urban Surface Water Management

September 25 and 26, Seattle. **\$475 by September 11, \$510 thereafter.**

Stormwater Treatment by Media Filtration

October 17 & 18, Seattle. **\$535 by October 3, \$575 thereafter.**

Mentoring and Coaching Workshop -NEW

October 22, Seattle. **\$310 by October 8, \$345 thereafter.**

Achieving Real Success as a Project Manager

October 23 and 24, Seattle. **\$475 by November 6, \$510 thereafter.**

Biofiltration and Bioretention for Stormwater Runoff Quality Enhancement

November 7, Seattle. **\$310 by October 24, \$345 thereafter.**

Effective Project Negotiation Skills

November 13, Seattle. **\$310 by October 30, \$345 thereafter.**

Wetland and Upland Habitat Restoration: Design Considerations for Increased Success -NEW

November 20 and 21, Seattle. **\$475 by November 6, \$510 thereafter.**

Pacific Northwest Transportation Technology Expo

September 11-12, Grant County Fairgrounds, Moses Lake.

Contact: WSU Conferences and Professional Programs

Phone: 1-800-942-4978 or (509) 335-3530

wsuconf@wsu.edu

Road and Street Maintenance Supervisor's School

East Side: October 1-3, Spokane.

West Side: November 19-21 (this is a date change), Tacoma.

Contact: Kelly Newell at Washington State University

Phone: 1-800-942-4978

NorthWest Pavement Management Association (NWPMA) Fall Conference

October 1-4, 2002, West Coast Hotel, Kennewick.

Contact: Bob Brooks at WSDOT for information

Phone: (360) 705-7352

42nd Annual Idaho Asphalt Conference

October 24, 2002, University Inn, Moscow, Idaho.

Contact: University of Idaho Conferences and Events

Phone: (208) 885-6662

Washington State Chapter APWA Fall Conference

October 29-November 1, 2002, Spokane.

Contact: Katy Allen at (509) 625-6300 for information.



For the Evel Knievels...Jump at will (except to access)?!!!

Clay Wilcox, Assistant Maintenance Superintendent at the WSDOT Port Orchard Maintenance Shop, and his wife, Loretta, came across this unique sign in Scotland on a recent trip to Europe.



Sign of the Times

Do you have a humorous traffic sign to share? Send us a print or e-mail a digital image (preferably a 300 dpi, 1000x1500 dpi jpeg or tiff) and we will add it to our collection for publishing. Please provide your name, title, agency or company, and a short description of where and when you saw the sign. We want to give you credit for your participation.

You can e-mail the image to SundeD@wsdot.wa.gov

Or mail the photo to:
"Sign of the Times"
WST2 Center
PO Box 47390

Please don't send your original photo. Although we will do our best to return the photo, we can't guarantee it.

Washington State Technology Transfer

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